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SPINAL ANESTHESIA*

DANIEL A. ORTH, M.D., F.A.C.S.
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In the preparation of this paper for presentation to this assemblage, we have made a comprehensive and exhaustive search and study of all that has been written and done on spinal anesthesia. We have added to what we have learned of the accomplishments of other medical authorities, the experience and knowledge of Dr. George Mueller, Dr. S. R. Pietrowicz, and the writer.

Spinal anesthesia is not a novelty; on the contrary, as you all know, it is in daily use, and we should like to make it clear that we claim no originality in the use of spinal anesthesia, but we have faith in it, and in presenting our method to you, we do so in the hope and with the thought that it will prove of some benefit to you and humanity.

I would like your indulgence while I pay a slight testimonial to the man, who has been my inspiration and counsellor since the time I was admitted to practise in our ancient and honorable profession. The notable man to whom I have reference, is the internationally known past President of the American College of Surgeons, Professor A. J. Ochsner.

From our success with spinal anesthesia, we feel justifed in encouraging others to employ the method with handicapped patients, where a general anesthesia is contraindicated, in operations below the costal arch.

HISTORICAL EVOLUTION.

The history of spinal anesthesia begins with the experiments of Dr. J. Leonard Corning, in 1885, employing cocain. His method, notwithstanding several successful experiments, did not meet with general favor and was accordingly dropped until taken up some years later by Bier, of Kiel (1898). Bier also used cocain, practising on himself, his assistant and six patients. In all these experimental cases, anesthesia was produced up to the umbilicus. In the *Deutsche Zeitschrift für Chirurgie*, 1899, in which the above cases are reported, Bier urges great care in the use of the method on account of the dangerous effect of the drug. While Bier urged extreme caution, he predicted that the development of chemistry would produce a drug which could be safely used in spinal anesthesia.

Bier was ever on the lookout for a satisfactory drug and, in 1905, at the German Surgical Congress, he called attention to the use of stovain, discovered by Fourneau, in 1904, which, when used with one of the suprarenal preparations, considerably lessened the danger attending its use. Bier, at this time, expressed the opinion that spinal anesthesia could be recommended for clinical use, although it had not yet been perfected.

Credit for the *first surgical operation* under spinal anesthesia in America, is given to Tait and Cagliere. Ostectomy of the tibia was successfully performed with 3 per cent solution of cocain, in a patient 54 years of age.

The distinction of *perfecting the technic* belongs to Jonnesco, and his report, in 1908, to the Congress of the International Society of Surgeons in Brussels, popularized the method, and spinal anesthesia began to be used extensively. Unfortunately, there was a reaction—due entirely to the recklessness with which the method was employed—and the result was, that when statistics were compiled, they showed that ether anesthesia had a much greater range of safety.

THE USE OF APOTHESINE.

To give a successful spinal anesthesia, attention must be paid to the smallest details to avoid untoward results. *The purity of the drug* and its liability to decompose, play an important part, as does the combined effect of the preliminary narcotics.

We employ apothesine with adrenalin for the following reasons:

1. It is about six times less toxic than cocain when combined with adrenalin preparations.
2. Recovery from toxic doses is very prompt.
3. It has little action on the motor cells, thereby lessening motor paralysis.
4. It stands boiling without any perceptible loss of activity. Decomposition, if any, does not exceed 1 per cent of the amount of apothesine. No toxic products result from sterilization by boiling. The products of hydrolysis of apothesine are less toxic than the anesthetic itself.
5. It is free from irritating action.
6. It is physiologically compatible with adrenalin preparations.

The last advantage is of great importance because:

(a) Spinal anesthesia causes a considerable fall in blood pressure, by cutting off nerve communication with the vasomotor center in the brain from a large vascular field, the splanchnic area and the lower extremities. (Crile-Anoci Association, p. 126). This is prevented by the direct action of adrenalin on the muscle fibers in the vessel wall, independently of the vasomotor system.

(b) Adrenalin prevents too rapid absorption of apothesine into the circulation by contracting blood vessels in and about the nerve roots, thereby minimizing toxic symptoms.

(c) It increases the anesthetic potency of the drug, prolonging the anesthetic period, and thus increasing the efficiency of relatively small doses.

DOSAGE AND PREPARATION OF SOLUTION.

Apothesine and adrenalin are conveniently supplied in tablet form, each tablet containing apothesine gr. 3/5 and adrenalin gr. 1/1600. Two tablets are dissolved in 3 c.c. of distilled water, for operations below the umbilicus, making a 2 2/3 per cent. solution.

*Read during the Third Annual Congress of Anesthetists, the American, Mid-Western and Chicago Anesthetists, in Joint Meeting with the National Anesthesia Research Society, Auditorium Hotel, Chicago, June 9-14, 1924.

Above the umbilicus, three tablets are dissolved, making a 4 per cent solution.

The dosage is further regulated according to the condition of the patient. In debilitated subjects, or in those in whom there is a low intra-spinal pressure, 1/2 to 2/3 of the apothesine is injected, as the case may require, which I shall explain later on. If this dosage is not sufficient to produce complete anesthesia, a light ether anesthesia will generally suffice.

These tablets can be relied upon in every way with the exception of their sterility. Although apothesine has definite antiseptic action, killing the gonococcus in 1, 1 1/2 and 2 per cent solution, or over, (thereby lessening the danger of infecting the spinal sac with septic organisms), it is not sufficient to depend upon this for self-sterilization of the solution. Therefore, it is necessary to sterilize the solutions made from these tablets before use. Our solutions are prepared as follows:

An ordinary test tube and beaker are boiled for fifteen minutes in water free from bicarbonate of soda. We specify this because both apothesine and adrenalin are chemically affected by alkalies. For the same reason, we boil our trocar, syringe, etc., in water free from bicarbonate of soda. Utensils and syringe are then carefully rinsed in freshly distilled water. We pour 3 c.c. of freshly distilled water (previously boiled for one-half hour) into the test tube, add the tablets, and bring to a boil six to eight times to sterilize. We do not boil the solution continuously, because adrenalin loses its effect by continuous boiling.

If the solution is not perfectly clear, but cloudy, it has come in contact with alkalies. Change in color to a brownish red is the result of decomposition of adrenalin by oxidation. Therefore, these tablets should be kept in air-tight containers, and the solution prepared just before the operation. Only clear and colorless solutions should be used. The solution is poured into the beaker, from which it is drawn into the syringe. The specific gravity of our solution is approximately that of the spinal fluid; consequently it remains where it is injected. Neither Babcock's lighter fluid, with alcohol, nor Barker's heavier solution, with glucose, has been tried.

The apparatus consists of a glass record-syringe, graduated to 15 c.c. and a needle of 10-karat gold. This needle has the advantage of being non-corrosive, is flexible and capable of prolonged boiling. The needle is five inches long, one-sixteenth of an inch in diameter, and holds a stylet to prevent clogging when introduced.

The bevel of the needle is short—not too sharp nor too dull. If the bevel is too sharp, you will pierce the structures without recognizing the resistence offered by the ligamentum subflavum, after piercing which the needle should be advanced cautiously—a little at a time—until it enters the sac.

If the bevel is too dull, it will push the dura in front of it, causing the so-called "dry tap" or failure.

If the bevel of the needle is too long, it may only partially enter the sac, spinal fluid will escape, leaving one to think the needle is within the sac, but when the anesthetic solution is injected most of it escapes extra-durally—again causing failure or partial failure. If a long, beveled needle is introduced far enough to overcome this objection, it may injure the cord, or the cauda equina, depending upon the site of injection.

Reversing By-Effects with Caffein Citrate.

During the operation, generally about ten minutes after the injection, some patients show signs of nausea and vomiting. This is due to a drop in blood pressure and should cause no alarm, unless accompanied by respiratory depression, as evidenced by "air-hunger."

If respiratory depression sets in at this time, it is due to an overdose of the drug—the toxic dose passing into the general circulation—and its action on the brain cells.

If respiratory failure sets in at the end of operation, it is due to anemia of the brain, resulting from poor blood pressure, and generally occurs from a sudden change in posture, as from the Trendelenburg to straight position.

As the *principal drawbacks* to spinal anesthesia *are circulatory and respiratory depression,* we anticipate these by administering, as stated before, adrenalin with apothesine, and a subcutaneous injection of caffein citrate, grs. 3, one and one-half hours before operation, one grain just after the anesthetic is administered—the latter dose being repeated every hour for six doses after the operation.

The reason for administering caffein citrate one and one-half hours before the operation is because the maximum of stimulation begins from forty-five to ninety minutes after it is administered.

Caffein citrate has three important activities when taken into the body,

1. It stimulates the whole nervous system—acting from above downward—brain, medulla and the spinal cord.

2. It stimulates all muscle fibers—striped, plain and cardiac.

3. It is a diuretic.

By its action on the brain it stimulates psychical functions. It produces a sense of wakefulness and counteracts the drowsiness produced by the morphin sulphate given as a preliminary narcotic. This is of importance in that it is necessary to have the patient's co-operation to prevent and to overcome symptoms of circulatory depression.

By its action on the medullary centers, vaco-constriction takes place, and respiration is stimulated, both the number and depth of respirations are increased; hence, respiratory depression, whether due

to a toxic dose or to a low blood pressure, or both, is eliminated, or greatly diminished, by giving caffein citrate before and after operation, as already described.

By its direct action on the vessel wall, vaso-constriction is further aided, which together with the stimulating action of the heart muscle, increases blood pressure, and as a result of good blood pressure, nausea and vomiting are eliminated.

Caffein citrate also stimulates the flow of urine by its direct action on the renal epithelium and by maintaining or increasing the blood pressure.

The effect of its diuretic action was emphasized by your Secretary-General, Dr. F. H. McMechan, in his discussion of our paper on spinal anesthesia before the Chicago Society of Anesthetists several years ago. In that paper we stated that the occurrence of oliguria after ether anesthesia, and its absence after spinal anesthesia, was very noticeable, even to the nurses, in our complete hysterectomies, where we make it a practise to insert a retention catheter. We quoted Salvador Pascual, of Madrid, on "Renal Physiology and Spinal Anesthesia," in which he says that oliguria, following general anesthesia, may be due to either direct action of the anesthetic, or to that deprivation of food and drink that the patient suffers after narcosis. Dr. McMechan argued that even though spinal anesthesia does not affect the kidneys, and that spinal patients were not deprived of food and drink, the diuretic effect of caffein citrate had to be taken into consideration.

Since reading this paper, we have observed in cases in which we had a drop in blood pressure of from 20 to 30 m.m., without any symptoms of circulatory or respiratory depression, that during the first 24 hours, the amount of urine voided was less than one-half the quantity voided the following 24 hours, when the blood pressure again reached its normal height. In none of these cases was there any increase until the blood pressure rose.

In those cases in which the drop did not exceed 10 m.m., there was only a slight difference in the amount of urine passed the first and second 24 hours. This shows a direct relationship between the blood pressure and the amount of urine voided.

Preliminary Preparation.

We recognize the advisability of employing morphin sulphate as a preliminary narcotic, for the following reasons:

1. It brings the patient into the operating room without fear.

2 It prevents restlessness on the operating table which is an advantage, as movements of the head induce nausea and vomiting.

3. It produces a more profound anesthesia with a smaller amount of apothesine. This makes it especially valuable in acute inflammatory conditions of the abdomen, in which anesthesia is harder to obtain, on account of intense irritation of the nerves.

One hour before operation, one-fourth grain of morphin sulphate is injected, and just before moving patient to the operating table, gr 1/8. But in debilitated subjects, one-fourth grain is generally sufficient, and if, together with this, they have a low intra-spinal pressure, the apothesine is reduced one-half. Whereas, if the intra-spinal pressure is normal, it is reduced to two-thirds.

Preliminary preparation such as diet, catharsis, etc., is unnecessary, which makes this method of anesthesia especially valuable in emergency surgery. The postoperative phenomena are the same in those who have been carefully prepared.

Cases not emergency are prepared as for a general anesthesia. Water is allowed up to the time of operation.

Posture and Injection.

Just before operation, the patient is blindfolded and quietly moved to the operating room. He is placed on his right side, his back is asepticized with benzine, followed by a 4 per cent tincture of iodin, which is washed off with 95 per cent alcohol. The field is protected by sterile towels, the operator, after observing strict aseptic precautions, identifies his landmarks by placing a towel from crest to crest of ilium, which is on a line with the center of the body of the fourth lumbar vertebra, and injects the skin at the site of puncture with a two per cent solution of apothesine. An assistant lends aid by holding the patient's legs and head in such a way that the back is bent to increase the space between the lumbar spinal processes (the Katzen-Puckel of the Germans). The needle is introduced about one-half inch to the side of the middle line and *not in the middle*, so as to avoid the extra-dural plexus of veins which are in the middle line. Enough cerebro-spinal fluid is withdrawn to equal the amount of apothesine solution to be injected.

We have experimented with both the sitting and the lateral postures, and have a preference for the latter. By administering the anesthetic with the patient in the lateral posture, the immediate accidents such as pallor, headache, syncope, etc., are decreased or avoided. They are never dangerous, pass off rapidly when the patient is placed in the lateral posture, but should be avoided as they may induce an unsuccessful anesthesia in a nervous patient.

The site of puncture depends upon the height of the anesthesia required. The most favorable site is in the lumbar region. The spinal column slants sacrally and dorsally between the third and fourth lumbar vertebrae; hence, when we require a low anesthesia, we inject between the fourth and fifth; and when a high, between the second and third lumbar vertebrae.

The spinal cord ends in the conus medullaris, from

which springs the leash of nerves called the cauda equina, at the lower border of the first lumbar vertebrae. We select a site below this point in order not to injure the spinal cord. Between the first and second lumbar vertebrae, the nerve roots are arranged in right and left bundles, with a small space from two to three m.m. between them. Unless you strike this space, you will inject into this bundle of nerves on either side and get a unilateral anesthesia. When this occurs, the patient will jerk his leg and complain of pain.

Below the second lumbar vertebrae, the nerve roots are more evenly spread out, filling the whole space, but leaving free room for the solution to filter through. When the needle enters here, the cauda equina is generally pushed aside.

The height to which anesthesia extends depends further upon the amount of the drug, (more in high) and upon the amount of solution; the greater the amount, the higher the anesthesia. We increase the amount of our solution by withdrawing and mixing sufficient cerebro-spinal fluid to equal the amount required, as follows:

For perineum, external genitals and lower extremities 3 c.c. of 2 2/3 per cent solution is injected between the fourth and fifth lumbar vertebrae, without the addition of cerebro-spinal fluid.

For operations below the transverse colon, 3 c.c. of 2 2/3 per cent solution, plus 4 c.c. of spinal fluid, is injected between the second and third lumbar vertebrae. This brings our solution high enough to anesthetize the tenth inter-costal, which innervates the peritoneum immediately above the navel, the eleventh immediately below the navel, and lower down the eleventh and twelfth inter-costal nerves.

For high abdominal operations, above the transverse colon, we use 3 c.c. of a 4 per cent colution, plus 7 c.c. of spinal fluid, and inject between the second and third lumbar vertebrae. This brings our solution high enough to paralyze the sensory nerve roots up to a level with the spinous process of the fifth dorsal vertebra.

The injection is made very slowly, as a rapid injection increases the height of anesthesia, which already has been provided for by the dosage and amount of our solution. The needle is withdrawn with a quick jerk, and the puncture sealed. As soon as the injection is completed, we place the patient on his back with a pillow under his head, to prevent bulbar complications. In ten or fifteen minutes the greater part of the anesthetic solution is absorbed by the nerve roots reached by our injection. This makes it perfectly safe to place the patient in the Trendelenburg position after this time. The unabsorbed solution, after ten minutes, is too weak to produce anesthesia by diffusion higher up.

The nurse in charge, sitting at the head of the patient, keeps the patient talking and taking deep breaths, to keep his brain active and stimulate the respiratory centers. Remember a talking patient is a favorable patient. She also sponges his forehead, lips and neck with cold water, all of which have a quieting effect on the patient.

Complications.

The after-effects of spinal anesthesia are few, and consist chiefly of headaches, incontinence of urine, and temporary paralysis of the sphincter ani. These annoyances last from three to five days and require no special treatment. Postoperative nausea and vomiting occurred in less than one per cent of our cases and was not accompanied by constant retching and straining. Persisting headaches, paraplegia and medullary lesions which are attributed to spinal anesthesia are unknown to us, but may be due to syphilis or to faulty technic.

There is a marked and favorable contrast in the condition of patients who have been administered a spinal anesthetic, as compared with a general anesthetic patient, and this has been observed and commented upon by fellow patients, nurses, attendants and visitors. The patients usually return from the operating room conversing about the wonders of their own operation, or soon fall asleep and awaken actually refreshed. Inhalation pneumonia from aspiration of mucous and ether is eliminated.

The toxic symptoms, as observed by us when we first employed novocain, such as nausea, vomiting, faintness, dyspnea, rapid, feeble pulse, pallor, etc., were due to too rapid absorption of the drug into the circulation. These toxic symptoms were observed in our patients, especially the younger, when we used solutions that had turned color to a brownish red, due to decomposition of the adrenalin. But since using only clear solutions, together with caffein citrate subcutaneously, as already mentioned, these toxic symptoms are light and rarely occur.

The only death we have recorded was a patient, 65 years old, with a bad heart. The solution was colored a brownish red, due to decomposition of the adrenalin preparation; consequently, it was inactive and allowed too rapid absorption of novocain, which we employed at that time. In a patient with a good heart the dose we employ would have no further effect than to cause toxic symptoms, which disappear promptly by having the patient take deep breaths, or by artificial respiration, together with a hypodermic injection of caffein citrate, gr. 1, and placing him in the Trendelenburg position.

In patients, however, suffering with poorly compensated valvular lesions, who have no reserve fund of cardiac strength to draw upon, death may be the result.

We have classified our operations into four groups, and thus give a fair presentation of what we consider indications for its use:

Group 1.—This is the largest group and consists

of 900 cases, in which the wisdom of using a general anesthetic had to be carefully debated, because of heart, lung, kidney, and liver conditions. The heart lesions included valvular disease with poor or broken compensation, myocarditis from the toxines of alcohol, previous acute infectious disease, thyroidal hypersecretions and obesity. Lung and bronchial lesions included pneumonia, bronchitis and asthma. Liver diseases were chiefly limited to cirrhosis and gall bladder affections. The operations in this group represented appendectomies, cholecystotomies, cholesystectomies, gastro-enterostomies, ovarian cysts, cesarean section, tuberculous and septic peritonitis, nephrectomies, herniotomies, Lane-plate, and autogeneous bone work on the lower extremities.

Group 1.—This group consisted of over four hundred cases where the prevention of surgical shock was a serious problem, as in intestinal resection for strangulated hernia in old people, thigh and leg amputation for senile and diabetic gangrene, prostatectomies, extirpation of rectal carcinoma, and abdominal gunshot and stab wounds.

Anoci-association is obtained by spinal anesthesia. It causes a complete nerve block, by blocking the transmission of impulses from the periphery to the brain, preventing surgical shock. It is the emergency method in these cases.

In diabetic cases, we find that after a short preliminary treatment, the patients are fair risks for spinal anesthesia. Even those not in favor of its use prefer spinal anesthesia to a general in these cases.

I well remember the beginning of spinal anesthesia in Professor Ochsner's clinic, where it was my great pleasure, during the World War, to work with and assist Professor Ochsner. We had been administering spinal anesthesia for a number of years at St. Mary of Nazareth Hospital, Chicago, but Professor Ochsner did not take to the method, and I was greatly surprised when I was asked to give a spinal anesthetic to a feeble, old lady, suffering with senile gangrene of the left leg. The operation was performed near the noon hour and while Professor Ochsner was closing the wound, this dear old lady said: "I wish you would hurry, Dr. Ochsner, I am very hungry, and afraid I will miss my dinner."

We gave quite a number of spinal anesthetics in Professor Ochsner's clinic after that in urgency surgery of the aged, especially physicians, and I am very happy to say, successfully. Today, it is not unusual to see two or three spinal aneshetics listed in Professor Ochsner's clinic.

Group 3.—This group consisted of over 75 cases and represented border-line cases which were not seriously enough involved to be included in either of the above groups, and could have taken ether if administered by an expert anesthetist.

Group 4.—This is the smallest group and consisted of only twenty-one cases. The patients in this group displayed dangerous symptoms while taking a previous general anesthetic.

We have observed in our abdominal work that the anesthesia sets in later in the perietal peritoneum than in the skin, muscle, fascia, etc., thereby causing a little delay. Permit me to emphasize here that any undue haste or rough manipulation will completely upset the entire anesthesia, making it necessary to resort to ether. A few minutes of waiting, with a little reassurance to the patient, who has felt the pain of the knife, careful manipulation of the peritoneum and viscera, and the anesthesia will prove to be perfect.

As a general rule, relaxation is more complete in spinal anesthesia, the abdominal wall is paralyzed and softened, and the intestines are contracted, which makes it invaluable in intestinal obstruction. A larger field of operation is the result, fewer laparatomy pads are required, and the operation is thereby more readily performed. There is also less difficulty in closing the abdomen.

Occasionally, in operations requiring a great deal of time, the anesthesia does not last throughout the entire operation. In such cases, ether is given to supplement it, which is generally for a very short period.

We have observed a few cases in which the anesthesia was apparently complete, but traction on the parietal peritoneum, as occurs in posterior gastro-enterostomies and intestinal resections, causes pain; ether is given while traction is being made, but none during the remainder of the operation.

Failures are due to unstable drugs, improper needles, slipping of needle out of sac, and faulty technic.

Contraindications: Blood pressure below 90; all operations above the costal arch; all operations requiring only a slight anesthesia; young, robust individuals; syphilis; superficial infections at or near the site of injection.

If unable to vouch for the purity of the drug, or the asepsis and thorough cleanliness of the apparatus, or the technic of the operator, spinal anesthesia is surely contraindicated.

Conclusions.

In analyzing spinal anesthesia, we have come to the following conclusions:

1. Spinal anesthesia is of distinct value in handicapped paients, in operations below the costal arch.

2. Spinal anesthesia can be given with a fair degree of safety by anticipating circulatory and respiratory depression.

3. It is best tolerated where most needed—in old people, due to slow absorption of the drug.

4. Spinal anesthesia, when properly given, causes no more discomfort than a hypodermic injection; whereas, nothing is more discomforting than going to sleep with and recovering consciousness from a general anesthetic.

5. Control is exercised by the site of injections, the proper dosage, the specific gravity, and the amount of solution.

6. No preliminary preparations are necessary. Fluids can be taken up to and right after operation, which is a decided advantage in renal cases and in the debilitated and weakened from any cause, where maintaining nutrition is of vital importance.

7. A strong recommendation is that by spinal anesthesia, *Anoci-Association* is obtained and operations causing much shock can be more successfully performed.

8. In renal, hepatic, and septic cases there is not the added strain of ether elimination to overwhelm the patient.

9. Makes better surgeons, careful manipulations and avoidance of traction being necessary; hence, traumatism is lessened.

10. Ideal in emergency cases.

11. Complete relaxation of the striated muscles and contractions of the smooth muscles are obtained, a decided advantage in intestinal operations.

12. Operating time is shortened; more being possible through a small incision because of a more complete relaxation.

13. There is lessened hemorrhage; this fact is very noticeable.

14. Postoperative retching and straining, nephritis or inhalation pneumonia, do not occur.

15. In a small number of cases we are compelled to give ether, but even in these cases it is very efficient with a small amount of ether, and the relaxation is more complete than general anesthesia.

16. Spinal anesthesia is not a surgical novelty, neither is it on trial, for it has proven its worth and has come to stay. It should be taught and every clinic should be prepared to administer it. We strongly urge all of you expert anesthetists to qualify yourself to give spinal anesthesia, because more surgeons would employ the method if competent spinal anesthetists were available.

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MINIMIZING THE PATIENTS' RISK IN SURGERY AND OBSTETRICS*

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Welcoming Remarks.

Mr. President, Members and Guests of the Associated Anesthetists of the United States and Canada:—

It is indeed a privilege and a great honor to appear before you in behalf of the surgeons, obstetricians, the medical profession in general, and the people of Chicago as their spokesman in greeting and extending to you a welcome as free and whole-hearted as the fertile plains which she represents.

Chicago, through her medical organizations, societies, colleges and hospitals, is greatly appreciative of the honor you do her by gathering in her midst for the exchange of ideas having to do with a wider knowledge of this technical subject in which you have labored so earnestly for the betterment of mankind.

In our endeavor to be most hospitable, we have prepared a program for both the mind and body, and trust that it will be as freely accepted as it is our purpose to give; that your visit with us will gladden your purpose in life, and that in years to come Chicago will always be a Mecca to the men and women, who, interested in scientific medicine, reach into the beyond for more light, for more understanding.

*Read during the Third Annual Congress of Anesthetists, the American, Mid-Western and Chicago Anesthetists in Joint Meeting with the National Anesthesia Research Society, Auditorium Hotel, Chicago, June 9-14, 1924.

Your Secretary-General has asked me to speak upon some topic pertinent to anesthesia. I have great pleasure in doing so, and the topic which I have selected is "Minimizing the Risk in Patients About to be Submitted to Surgical and Obstetrical Operation."

Anesthesia, in its present almost perfected state and as administered by such highly competent men and women as I have the honor of addressing today, has been robbed of most of its dangers. With the number of anesthetics now at hand and a thorough knowledge of their qualities and effects, almost any type of patient can be suited and the operator can proceed calmly with his work free from the fear of any mishap; or should some mishap occur, secure in the knowledge that danger can instantly be averted. *But the patient rightly demands more than safe anesthesia, and expects to be protected against any unpleasontness that may result from the anesthetic.*

That many unpleasant complications can arise is well known, and I desire especially to refer to that postoperative syndrome known as acidosis, because by suitable preanesthetic care, this complication can be largely avoided .The preoperative preparation of a patient is not within the scope of the anesthetist's duties, but he is entitltd to know the condition of the patient so that he may judge how far such condition is compatible with the administration of certain anesthetics.

As is well known most if not all general anesthetics are fat solvents and are absorbed by the fats of the body. This absorption is greater or less according to the degree and duration of anesthesia. Investigators have found that following ether anesthesia there is an increase of acetone bodies in the urine and a decrease in the carbon dioxid combining power of the blood plasma which denotes a decreased alkaline reserve and an early stage of acidosis. The normal CO_2 combining power of the blood in the adult varies from 75 to 55 per cent. If it falls to 50 per cent an acidosis may be suspected; and if the fall is much greater an anesthetic mishap may be expected. Moreover, it is found that when acetone and diacetic acid are present before anesthesia they are likely to be greatly increased following it.

Reimann and Hartman, some years ago, showed experimentally that definite changes in metabolism follow anesthesia. The resultant acidosis is probably catabolic and contributes very materially towards so-called surgical shock.

In a great many pathological and obstetrical conditions, which demand operative interference, the patient is already in a state of acidosis due to derangement of the metabolic and eliminative functions. If such patients are submitted to anesthesia and its necessarily increased acidosis, their risk is very much increased and they are much less able to withstand the surgical or obstetrical trauma.

Hence the importance of thoroughly fortifying such patients before submitting them to anesthesia.

For a long time, in our own practice, we have systematically subjected gynecologic and obstetric patients to a thorough preoperative preparation. We obtain a pretty accurate working knowledge of the patient's metabolism from careful urine examination. From long experience we know what is to be expected from a patient who shows marked deviations from the normal balances of the solid constituents of the urine. We, therefore, treat her systematically by alkalinization and a dietary restricted in proteins and fats for the added purpose of preventing excess acid formation and the resultant sequelae. Such a preparation may only take a week or ten days, but occasionally it may extend to months before the patient can run the risk of anesthesia and operation.

The anesthetist should know the metabolic condition of the patient just as much as he should know the cardiac and respiratory capacity, and when he knows the metabolic condition has been steadily improved by a systematic preoperative treatment, he will feel much more confident in regard to the patient's ability to withstand even a long and profound anesthesia.

Minimizing the Patients' Risk in Surgery and Obstetrics.

With the great advances in technic the operations of surgery and obstetrics have been rendered so safe that the risk to the patient is comparatively slight as far as the operation itself is concerned. But judged from the patient's point of view a surgical operation means more than technical skill. The operation and all surgical procedures connected with it may have been perfect; the wounds may heal rapidly, yet the operative results may be a failure. The patient expects to be cured and to be relieved from all distressing symptoms which are either directly or indirectly considered to arise from the condition for which he or she submits to the ordeal of operation.

It makes no difference how brilliant the surgery may be, if it does not result in a state of well-being it is a failure as far as the patient is concerned. Moreover, although surgery itself is fairly safe, the patient has a right to be protected against any unpleasant surgical sequella that can be avoided. Hence the surgeon must take cognizance of every step connected with the operation,—the anesthesia, the surgical condition of the patient, apart from the special lesion for which the operation is to be done, and the postoperative treatment are the necessary complements of the operation.

Anesthesia and postoperative care have probably received the attention which they necessarily deserve; but, in my opinion, preoperative preparation of the patient to successfully undergo the ordeals of

anesthesia and operation, and to obviate or at least minimize the possible complications of both, is not treated with the special importance it deserves.

It may be considered, as a general rule, that every patient, whose condition demands a serious surgical operation or who is to undergo the ordeal of labor, has a more or less disordered organism. Renal, intestinal and metabolic efficiency will be diminished. Pregnancy has its own special toxemias and the traumatism of labor often creates a *locus minoris resistentia* for germs which otherwise would be dormant.

We have them as a first postulate that such patients are more or less unfit to undergo the serious crisis by means of which they hope to be cured.

Statistics show that when surgical operation fail to produce the objective for which they were performed only a small percentage of failure is due to the operation itself.

What surgeons and obstetricians fear are the complications that arise following surgical operation. Shock, vomiting, and other intestinal disturbances, pneumonia, uremic or other intoxications, are conditions which if they do not actually carry off the patients, often leave them in a condition as bad if not worse than before, and nullify the effect of the most brilliant operative technic.

The object of this paper is to show that many such complications can be avoided or minimized by proper preoperative preparation of the patient; that the risks can be measured; that such preoperative preparation is as essential to success as operative technic or postoperative care; and that every surgeon, undertaking a serious operation, owes it to his patient to see that by suitable preoperative treatment the risks of anesthesia and surgery are minimized. These risks are sufficiently serious that nothing should be omitted which will diminish them.

The heart and respiratory organs require careful attention. As I pointed out in a previous paper, the respiratory suspension test if below normal means some organic trouble and especially cardio-renal insufficiency. In a series of 871 obstetrical cases which I reported, the respiratory suspension tests of the average parturient showed that she could hold her breath for 25 seconds. The shortest suspension (3 seconds) was in a case of cardio-renal insufficiency with general venous stasis, and that when a patient could not hold the breath 15 seconds she was a poor anesthetic and surgical or obstetrical risk.

The patient's risk arises both from the anesthetic and from the surgical procedures, and includes respiratory, renal and gastro-intestinal disturbances. All these are reflected in the metabolism, and the gravity depends especially on the general state of the patient.

Factors Contributing to Shock.

In these metabolic disturbances the postoperative shock varies considerably in different patients. The nature of this shock is a matter on which there is considerable divergence of opinion. In my own view, based on personal experience and observation, I am satisfied that so-called surgical shock is a metabolic end-result, probably catabolic in character.

In every surgical or obstetrical operation there are a number of factors which contribute to this condition, viz:—(a) psychic *i. e.* fear of the ordeal by the patient as well as the general mental depression, due to the pathological condition; (b) the effects of anesthesia on metabolism; (c) the manipulative trauma; and (d) hemorrhage.

(a) That the emotions affect metabolism and the organs regulating metabolism scarcely calls for discussion, as this has been proven by a number of investigators.

(b) Reimann and Hartman, a few years ago, showed experimentally that small but definite changes in metabolism follow anesthesia, and other investigators have found that ether anesthesia was followed by increase of acetone bodies in the urine and a decrease in the carbon dioxid combining power of the blood plasma showing a decreased alkali reserve and an early stage of so-called acidosis.

One of the important effects of general anesthesia, particularly in the case of chloroform, is the production of acidosis, and the degree of this acidosis depends upon the saturation and duration of the anesthesia. Though the exact mechanism of anesthetic acidosis is not known, there seems to be much truth in the opinion of Danneruether who thinks it is due to fat and carbohydrate catabolism. The principal anesthetics are all fat-solvents and are absorbed by the fats of the body hence it is quite clear that any important degree of anesthesia must be accompanied by great disturbances of metabolism.

(c) In abdominal operations especially, a condition of intestinal stasis is produced by the surgical manipulations. Absence of food, and preoperative purgation are other causes of postoperative inhibition of intestinal peristalsis. If this and other factors of the operation itself, such as increase of urine acetone bodies and increase of plasma bicarbonate be considered, there can be but little doubt that metabolism is directly interfered with by the operation.

(d) And the same may be said of an important loss of blood.

All these results follow in cases in which the patients are in a fairly good general condition; but what must be expected when the patients (as most of them are) at the time of operation are in a condition of very defective metabolism and autointoxication?

These are the type of patients about whom we are particularly concerned, and it may be taken as an axiom that no patients requiring a major operation are in a condition that does not call for some preoperative treatment.

It is in these surgical and obstetrical patients with impaired endocrines, faulty metabolism and faulty secretion and excretion that the most serious post-operative complications arise; and the importance of preoperative treatment lies in the fact that by it patients are built up to withstand the effects of anesthesia and surgical trauma, because their metabolic processes have been strengthened to a degree in which they can resist the attack upon them. This is why I say that preoperative treatment of the patient is as important to the ultimate outcome as the operative or postoperative treatment. If the patient is not in a proper condition to withstand the operative procedures, the surgical or obstetrical therapeutics will probably be failures as far as the end-results are concerned.

Qualitative and Quantitative Study of the Patient's Urine.

Every patient, who is to submit to a surgical or obstetrical risk, should have a thorough physical examination. Special care must be given to determine the functioning and excretory ability of the kidneys and the metabolism generally. As a general index of metabolic activity the results obtained from a qualitative and quantiative study of the patient's urine, repeated as often as necessary, will reveal any deviation from the normal ratios, and thereby serve as our best guide in preoperative treatment both in surgery and obstetrics.

If, in a healthy person, we collect all the urine voided from breakfast to bedtime, and then again from bedtime to breakfast, it will be found that the former considerably exceeds the latter in amount, even twice or more in volume. If we mix the two collections well, take the specific gravity at about 77° and determine the percentage of urea, we will find that the last two figures of the specific gravity divided by ten will not be much more than the per cent of urea.

By determining the titration acidity of the 24 hour mixture, obtained as mentioned, and also the so-called ammonia percentage of this same mixture of the two collections of urine, we will find that the amount of the decinormal sodium hydroxide used in each case will be about the same, or at any rate there will not be much more needed for the ammonia than for the acidity, though there may be considerably less. Comparison of the per cent of urea with the per cent of ammonia will show the former to be thirty or more times the latter.

If we test the mixture also for indican by use of Obermayer's solution we may find a slight blue color, but not a deep blue, if bowel conditions are normal. Uroerythrin will also not be found in appreciable amount. It goes without saying also that the usual well known tests for albumin, sugar, acetone bodies, urobilin, and bile will be negative and the microscope will not show casts, pus or blood.

What applies to the healthy person also applies in general to the woman in pregnancy in the main, although slight transitory deviations in the various balances of the normal constituents may be met with from time to time.

Analyses of many thousands of 24 hour collections of urine reveal a monotonous regularity in the mentioned balances of the normal constituents; hence when a person presents himself showing a disturbance of these balances such an individual becomes an object of interest to the physician or surgeon and especially to the obstetrician. Clinical experience, with several hundred such unusual persons in the pregnant state, has shown, beyond the shadow of a doubt, that disturbances of these urinary balances mean trouble for the *accoucheur*. A pregnant woman, whose urine differs *quantitatively* from that of the general run of pregnant women, is herself different from the general run of pregnant women. She becomes a person to be watched for unfavorable developments whether any other reason for such watching is apparent or not.

The technical points in the urine study have been described in detail by Clifford Mitchell (*Current Researches in Anesthesia and Analgesia,* August, 1922). To give an illustration of how the urine may differ from normal in cases of toxemia of pregnancy consider the following report of an analysis. Primipara, seventh month, volume of day urine, 500 c. c.; of night, 700 c.c.; total, 1200 c.c.; specific gravity, 1012; acidity, 30 degrees; urea, 0.8%; ammonia, 0.085%; acidity-ammonia (formal balance) 0.6 to 1; urea-ammonia balance less than 10 to 1; indican, marked blue; sugar (glucose) plain traces both day and night; albumin, acetones, bile, urobilin, blood, pus, casts, all negative.

Years ago such an analysis would have meant practically nothing to us. Today it means everything, since to be forewarned is everything in pregnancy, as well as in surgery. In such a case we need not wait for more obvious manifestations either in patient or in urine. We know from experience that the patient is absolutely in the grip of toxemia and it remains merely for us to get busy and find out what to do for her.

Please observe that, regardless of the total volume of urine in 24 hours or of the total amount of urea in 24 hours, it is the relationship of the various percentages of the solids of that total collection of urine with which we are concerned, and also that the total quantity of so-called ammonia in 24 hours appears to be of significance in that any pregnant woman who voids more than 0.5 grammes of ammonia in 24 hours is an object of suspicion, *always provided* that the total amount of urea in the same collection is not proportionately increased. Notice also that we use the expression so-called ammonia, because authorities are not agreed upon just what the formal

determinations show. But just what it shows, we have found from thousands of analyses to be of clinical importance in pregnancy, because the figures obtained for acidity and of so-called ammonia will balance in health and do not balance in certain toxemias of pregnancy. We leave it to the chemists to find out the why and wherefor.

It goes without saying, however, that the collections of the 24 hour urine must be prevented from decomposition, which may be prevented if they be collected in clean jars and kept in a cold place, as in a refrigerator. Collections in an ordinary chamber vessel, as a rule, are not trustworthy for examination, nor is a single specimen of urine voided at some particular time in the day, as a rule, of any value. The reason why the value of these balances was not discovered in days past is because no care used to be taken to prevent formation of ammonium carbonate, which substance utterly vitiates the conclusions to be drawn from the quantity of other ammonia. The urine of pregnant women decomposes rapidly, hence analysis in the past discovered nothing, as the urines examined were either single specimens or else decomposed collections of the 24 hour output.

In general, any urine which has a foul odor is not worth examining for the balances in question, and we should not attempt to draw clinical conclusions from the analysis of any such foul smelling collection.

I have dwelt thus long on the urine examination of the parturient, because what we have found is of equal importance for surgical operative cases.

If a patient shows either acetone bodies in the urine; or a relative excess of ammonia compared with urea; or of ammonia with acidity, especially when coupled with traces of sugar, showing carbohydrate intolerance, and perhaps also a marked indicanuria in urine of not high specific gravity, he (or she) is exhibiting marked metabolic disturbances and is a poor anesthetic, obstetric and surgical risk.

PREOPERATIVE PRECAUTIONS.

If acidosis is marked we endeavor to minimize it as much as possible by a thorough alkalinization of the patient for several days before operation.

As is well known postoperative uremia is directly traceable to the retention of urea-nitrogen beyond normal limits.

If the patient shows auto-intoxication, which is evidenced by the unsatisfactory figures for urea, acidity, and indican, we try to correct it by systematic dieting and any other means that will accelerate the output of urine with normal or nearly normal ratios.

In the pregnant the dietary restrictions are begun several months before labor is expected. If the urine reaches normal conditions the restrictions may be modified, and in surgical patients, under like conditions, one may proceed in comparative safety with the operation. Patients, in whose urinalysis there are found to be disturbances of these balances, must have the morbid processes corrected as far as possible before they can be considered fit to undergo anesthetic or operative risks. If such preoperative treatment fails to restore the urinary balances they must be considered as bad risks and so informed before operation.

Regarding the preoperative purging of patients: There was a time (perhaps in some cases it is still with us) when a dose of castor oil the night before and a saline on the morning of the operation was considered all that was necessary; but we are getting away from that, if not for the patient's sake, at least for our own reputation.

In our own practice we avoid cartharsis in the preoperative treatment, as its tendency is to weaken the normal detoxicating power of the intestinal tract and to dehydrate the patient. This same remark applies to immediate preoperative purging, and in this connection I am glad to note that the undesirability of this, especially in abdominal surgery, has been pointed out by others, Taylor, Terry and Alvarez, for example.

Those surgeons who have adopted systematic preoperative treatment of their patients have found it to give most gratifying results. Cary found that preoperative alkalinization unquestionably lessened postoperative complications and postoperative catheterization, and that gas pains were reduced to the vanishing point.

Geist and Somberg, as well as Lilienthal, have found that methodical preoperative digitalization has obviated postoperative pulmonary complications. More recently Geist and Goldberger have found that preoperative digitialization reduced postoperative complications to 3 per cent. The general average of such complications running from 8 to 27 per cent.

Danneruether systematically alkalinzes his surgical patients for 3 to 4 days before operation, extending this period if acidosis is marked.

Hart has found that the practical application of preoperative treatment of patients, who have shown abnormal acidity, indican or urea, resulted in a marked decrease of operative mortality. In his gastrointestinal cases following such treatment there was almost total absence of shock.

Glass and Wallace found that systematic preoperative treatment by sodium bicarbonate and lactose gave a postoperative slightly acid urine and a very great reduction of acetone bodies. None of their patients showed a severe acidosis and nausea was much diminished.

CONCLUSION.

In conclusion, our plea today is for a more intimate knowledge of the physio-pathological conditions

of the pregnant woman and the prospective surgical patient; realizing that through an earnest study of the subject as a whole, with special attention to a qualitative examination of correctly collected 24 hour urine, disturbances of metabolism may be discovered, the correction of which through ante-partum or pre-operative treatment will minimize the patient's risk in obstetrics and surgery.

122 S. MICHIGAN AVE.

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CLINICAL EXPERIENCES WITH ETHANESAL ANESTHESIA.*

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During the seventy-eight years which have elapsed since the first demonstration of ether at the Massachusetts General Hospital, nothing has been found to take its place as an all-around general anesthetic.

During this time a large number of substances have been presented by different investigators for anesthetic purposes, only to be found impracticable; nevertheless, the investigators go on hoping to find the ideal anesthetic. When we mention "ideal" anesthetic, what do we mean? Any single anesthetic agent which will prove universally satisfactory in all surgical cases. Probably such never will be found.

The necessary qualifications of such an anesthetic applied to our present day surgical indications are many. It should have no ill effects, immediate or remote, upon the patient. It should render true physical relief from suffering, and should be applicable over several hours duration without deleterious influence upon the patient. To be practical, it must admit of convenient and simple use. It must present to the surgeon a patient in satisfactory condition. For various reasons this latter is doubtful. *First*, the patient is broken in health by the pathological conditions that call for an operation; *second*, the psychic state is far from normal.

The initial mental perturbation in anesthesia is that due to the disturbing ideas implanted in the patient's mind by friends or visitors. He is informed that they have experienced exactly what is before him and they call his attention to all the real or imaginary concomitants that they experienced in connection with their anesthesia. Thus, in the mind of the patient, who under the circumstances is peculiarly receptive of such information, ideas are implanted which cause him to anticipate his coming anesthesia with dread or even with fear.

Another source of mental disturbance is the waiting by the patient for anesthesia after he has been told the anesthetist is ready, or has been removed from his room for it. During this time all sorts of ideas form in his mind, and however false or grotesque they may be, their continuance may augment the intensity, so they may assume the importance of verities and play the part of impressions formed by the senses during such a period of waiting. The mind is peculiarly receptive of impressions by the senses, particularly those of sight and hearing. For the patient this period of waiting is a period of dread, even of terror and fear, and impressions made under such circumstances are deep and lasting, and may manifest themselves during subconsciousness, thus preventing a smooth anesthesia.

The reasons are many—there is a feeling of dread, dread of the anesthesia, dread of the operation. There is the feeling of fear that something may go wrong, that the findings of the operation may be unfavorable. Then there is the feeling of complete helplessness. The patient feels he must give himself often into the hands of strangers who can do with him as they please; that he, himself, will have no control of the situation. Then there is that feeling which to all or many patients, is the worst, *viz*: the voluntarily closing the eyes on the world with the possibility of never opening them here again. All these ideas make the mind peculiarly sensitive and the most insignificant impression at this time is a lasting one.

There are many other psychic conditions that could be mentioned but I will not take the time. The more experience I have had has convinced me that as anesthetists we do not study our patients as much as we ought to, especially the psychological side, and I am convinced that many of the sequels of the anesthesia are psychic. For that reason let us approach the patient not as a case, but as an individual or human being, thereby inspiring confidence and faith so as to have his full cooperation, thus partially preventing or rendering less severe the after effects of the anesthesia.

ETHANESAL ANESTHESIA.

This brings me to the subject of this paper, "*Clinical Experience with Ethanesal Anesthesia.*"

A new form of ether for anesthetic use recently

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produced by Wallis and Hewer, ethanesal has been used as an anesthetic quite extensively in London hospitals; also Montreal, Toronto and Winnipeg, with very satisfactory results.

I received two consignments of ethanesal. From the first I anesthetized sixteen persons with great success. The average amount used for each patient was three ounces.

Three of these patients were poor risks for anesthesia; one was afflicted with a severe heart lesion; one had chronic nephritis, and one who had taken anesthetics several times, had a horror of them; the smell even caused nausea and vomiting; she took ethanesal without resistance.

These sixteen cases took ethanesal with ease, no resistance or struggling; pulse full and regular, respiration normal, and good color, though three were slightly nauseated.

I anesthetized eight patients from the *second* consignment. The results were far from satisfactory. The average amount used for each of this series of cases was eight ounces. One a very complicated hysterectomy lasted two hours; she took twenty-four ounces of ethanesal.

During the operation these eight patients took ethanesal very well, color, respiration, pulse very good. Soon after operation, they became very much cyanosed; slow pulse, persistent and distressing nausea and vomiting, which continued for several hours. When patients became conscious they complained of bad taste.

I will quote here a letter which I received from Savory & Moore, Ltd., the manufacturers of ethanesal, as follows:—

Ralph P. Beebe, Esq., M. D.,
Kalamazoo, Michigan, U. S. A.:

Dear Sir:—

Messrs. E. Fougera & Company have forwarded your letter on to us.

It is difficult to say, without an examination of the bottle or knowing from which batch the ethanesal you used came, what is the matter with it, and we should, therefore, be very much obliged if you could let us know the letter and number stamped on the labels of the bottles of ethanesal with indelible ink. When we have this information, we can examine the control kept in our factory. We think it is quite possible that your suggestion that some chemical decomposition has taken place is correct. We had some trouble in this matter about twelve or fifteen months ago, but the cause has now been remedied. We very much regret that you should have had this unsatisfactory experience, and if you will let us know how many bottles you found unsatisfactory, we shall have much pleasure in replacing these with good stock. The reports which we continue to receive about the use of ethanesal are extremely gratifying, so the fact that your experiences have not been so happy is causing us many regrets.

We are, Sir,

Yours faithfully,
Savory & Moore, Ltd.,
C. H. Savory, Director.

Advantages Claimed.

The advantages claimed by proponents of ethanesal are:—

(1) It is less toxic than chloroform or ether and the safety margin is greater than with ether.

(2) It is less irritating to the respiratory tract than ether.

(3) Postanesthetic vomiting is less than with chloroform or ether.

(4) The taste and smell noticed afterwards by patients are much less than with ether, and are generally absent.

(5) The pulse pressure is higher than with ether or chloroform.

Wm. Webster, of The Winnipeg General Hospital, says the odor of ethanesal is more fruity, also less pungent, than that of ether and, therefore, not so irritating to the respiratory passages. The breathing is quieter, a light stertor being present, though much less obvious than that of ether. The other taste is less persistent and less unpleasant and salivation is also less. The stages of anesthesia are the same as with ether, but a little shorter.

The pulse rate is less than under ether; in the majority of cases being between 80 and 100. The blood pressure is not lowered to the same extent as with ether. Muscular relaxation is greater, relaxing to a degree approximating that produced by chloroform rather than that of ether. The quieter respiration causes less abdominal movement.

The quantity of ethanesal required is about two-thirds that of ether. Vomiting is somewhat lessened unless the anesthesia has been pushed to an unnecessary depth. The clinical results of the sixteen cases I anesthetized with ethanesal coincide with Webster's.

The Pure Ether Controversy.

MacKenzie Wallis carried out experiments until he obtained a pure ether which he found did not have anesthetic properties but produced a state of excitement with no true anesthesia.

J. H. Cotton, of Toronto, from previous experiments, had had the same results. Then the question arose with these experimenters which of the impurities produced anesthesia? Cotton added ethylene to pure ether, which was not entirely satisfactory, as the mixture was unstable; the ethylene evaporated rapidly when the container was opened and the mixture lost its advantageous anesthetic properties, or nearly so.

Wallis added ketones to the extent of 2 per cent, which he claimed produced a stable compound with anesthetic properties.

A painstaking investigation was reported by Dale, Hadfield and King, made by them for the purpose of throwing light on the claim that pure ether has little or no anesthetic action. They also report the result of their examination of ethanesal. They first made a purified ether, (*absolute diethyl oxid*) by a special method. It was free of all known impurities including ethylene and was first carefully tested in the laboratory on a number of cats. Induction

of anesthesia occurred smoothly and with a rapidity, at least equal to that normally seen when ordinary good anesthetic ether is administered. Such difference as was observable could be satisfactorily attributed to the smaller amount of pharyngeal, tracheal secretion provoked, the pure ether being distinctly less irritant than most specimens of ether sold for anesthetic purposes. This absence of irritation not only facilitated induction but enabled deep anesthesia to be maintained with a smaller quantity of ether. As a result of their experiments the authors believe that the purer the ether, the more easily and smoothly can anesthesia be induced and maintained.

When this pure ether was used for patients requiring anesthesia with ether for surgical operations, the results, like those obtained in experiments on cats, were decisive in favor of perfectly pure ether. The after-effects were no worse than those usually following anesthetic ether.

In the opinion of these investigators efforts to improve properties of ether as an anesthetic for ordinary use can be most profitably directed to the discovery of methods for rendering and keeping it free from the irritant impurities.

The experiments with ethanesal made by Dale, Hadfield and King failed to afford any evidence of anesthetic potency which is not satisfactorily accounted for by that of purified ether, which is the main constituent. Several samples of ethanesal were submitted to fractionation. The samples contained 95.5 per cent ether, 4 per cent of normal butyl alcohol, and 0.5 per cent of a mixture of ethyl alcohol and an aldehyde and possible traces of other substances.

This analysis showed a composition which differs from that claimed. These differences were called to the attention of the manufacturers of ethanesal who stated that normal butyl alcohol should not be a constituent of ethanesal, and its presence in the samples examined must have been due to an error. The authors claim they are left in a state of complete uncertainty as to whether any of the numerous published clinical observations of ethanesal were carried out with ether containing genuine ketones (as claimed by manufacturers) or with ether containing normal butyl alcohol (as found by the investigators) of which some portions had been oxidized to butylic aldehyde. Nevertheless, in view of their failure to detect any real difference between the action of ethanesal and that of pure ether (ether separated from it or prepared independently), they feel justified in requiring further proof before admitting that the nature of the added constituent could make any serious difference.

These investigators give no support to the statement that pure ether is devoid of anesthetic action, and that the activity in this direction of ordinary ether is due to impurities. On the contrary, their work shows that the anesthetic activity of ether is improved by purification. As an anesthetic the purest ether is the best. Further, there is no evidence to warrant attributing anesthetic properties of ethanesal to any other constituent than the ether.

The work of Stehle and Bourne, in Canada, and of Dale and his co-workers in England, demonstrates anew that notwithstanding the claims of proponents of so-called improved ethers, the theory of ether anesthesia is still unchanged.

Conclusion.

In conclusion: My experience with ethanesal has been too limited to draw a satisfactory comparison with ether or other anesthetics. The first sixteen cases anesthetized were very good; the second series of cases numbering eight were very unsatisfactory. The only advantages of ethanesal compared with ether, judging from the results of the first sixteen cases, were doing away with the disagreeable odor of ether; and the anesthetic being less pungent than ether does not irritate the respiratory mucous membrane to the same extent as ether.

In the second series of cases, numbering eight, the respiratory irritation and other sequels were very much aggravated.

If ethanesal is ever to be a success a stable compound must be produced and marketed, one that is dependable under all circumstances.

Bank Bldg.

ANESTHESIA IN THORACIC SURGERY.

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In an attempt to discuss the most satisfactory methods of anesthesia in thoracic surgery it is perhaps advisable to divide types of operations, ordinarily performed by the thoracic surgeon, into certain definite groups. For our present purpose we will assume that operations upon the breast and similar operations upon the chest wall do not come into our consideration.

Thoracotomy.

The operation upon the thorax most frequently performed is undeniably that of thoracotomy, either with or without rib resection, in the treatment of acute empyema. The anesthetic of choice in such cases is, I believe, always novocain (procain) infiltration anesthesia. Also I do not believe that it is of any great importance whether the strength of the solution employed be ½ of 1 per cent, 1 per cent, or 2 per cent.

If infiltration is reasonably carefully carried out, and an attempt is made to bathe the intercostal

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nerves both above and below the site of operation, the patient will suffer no pain nor will shock symptoms be produced. As is always the case when local anesthesia is to be employed it is important that the patient's confidence be obtained before operation; also it is usually of advantage to administer a small to moderate dose of morphin, hypodermically, one hour before operation. The administration of the opiate in this fashion is useful in that apprehension on the part of the patient is minimized, an attitude of lack of interest in the operative procedure is induced, and what is perhaps most important, coughing after the pleura is opened, is less likely to take place and is less likely to be spasmodic than if no respiratory sedative is administered.

Decortication and Pneumolysis.

In performing the operations of decortication and pneumolysis in chronic empyema I have employed practically all forms of anesthesia and have come to the conclusion that the most satisfactory technic is that of local infiltration of the chest wall, assisted by chloroform inhalation anesthesia to a degree which is never deeper than that which is ordinarily employed in obstetric work. Since in this operation the surgeon is very likely to tear the lung surface in one or more parts, and since in consequence bleeding into the lung parenchyma is likely to occur, it is very important that at all times during the course of the operation, or, at any rate, during that part of the operation in which the lung itself is being handled, the patient should exhibit the bechic reflex. I have personally come to the conclusion that unconsciousness and quietness on the part of the patient is more readily obtained, and the coughing reflex maintained, when chloroform is employed.

The thoracotomy which is necessary in order that decortication may be performed, is usually extensive. The thickened parietal pleura in such cases interferes,—often entirely,—with the effective use of a rib spreader. Consequently, it is usually necessary to remove the greater part of one rib and to section from three to six other ribs. Even after such extensive rib section, the employment of one or more rib spreaders is usually required. In order that such a large portion of the chest wall should be rendered anesthetic by means of local anesthesia, without the employment of too large a dose of the solution, paravertebral infiltration of the intercostal nerves is necessary. For this purpose I have employed 2 per cent novocain (procain). In addition, infiltration anesthesia along the line of incision with 0.5 or 1 per cent. novocain is usually necessary.

Since practically all cases of chronic open infected pneumothorax, for the cure of which the operation of decortication is judged necessary, have already been subjected to multiple operations upon the chest wall with partial resection of several ribs, rib resection and section is usually extraordinarily difficult, and more blunt dissection traumatism of the tissues is necessary than is the case in operating upon the previously unoperated chest wall.

It is for the reason out-lined in the last paragraph that, although in a fair proportion of cases, perhaps 35 per cent, sufficient exposure of the interior of the chest can be obtained without the use of a general anesthetic, in the larger proportion of cases the force necessary to isolate the ribs causes too much discomfort to the patient to render such a procedure justifiable without the obtunding effect of small doses of a general anesthetic.

Thoracoplasty.

The operation of extrapleural collapsing thoracoplasty is gradually becoming more and more frequently performed. There are indications that in the comparatively near future the treatment of choice in chronic pulmontary tuberculosis will be collapse of the chest wall by rib resection. This operation should be carried out in two stages, and if so carried out is not ordinarily the cause of much shock on the part of the patient. I believe that I am correct in saying that the anesthesia, which has now been accepted as indicated in this operation, is that of nitrous oxid-oxygen assisted by local infiltration of the chest wall with novocain (procain). Nitrous oxid-oxygen alone hardly suffices, as the patient is very likely to move unduly during the period of skin section, and also when the periosteum is being separated from the bone.

As is the case in the extensive thoracotomy necessary for decortication, paravertebral anesthesia, reinforced by local infiltration along the line of incision, may be employed. I am of the opinion, however, that it is more satisfactory to carry out local infiltration after nitrous oxid-oxygen anesthesia has been induced, and after the ribs have been uncovered, to inject along the lower border of each rib with novocain (procain) solution. If during this procedure a certain amount of the solution is injected beneath the periosteum, the separation of the latter is facilitated.

Pulmonary Abscess.

All cases of pulmonary abscess, in which the lung and costal pleurae are adherent, can and should be operated upon under local anesthesia. The chief advantage of local anesthesia in these cases is that if at any time the patient coughs and raises pus, this material can easily be gotten rid of, whereas, if he is under a general anesthetic, pus which reaches the main bronchus may be aspirated into the lung on the opposite side. Infiltration anesthesia with local blocking of the intercostal nerves is all that is necessary when but one rib is to be sectioned. When, on the other hand, portions of several ribs are to be removed, paravertebral anesthesia

should be used. When the site of operation is anterior to the posterior axillary line, infiltration anesthesia at the site of operation is necessary to supplement the paravertebral anesthesia.

In point of fact, the operation of thoracoplasty is not truly an intrathoracic operation, although, since it is always undertaken in the presence of serious disease of the lungs, special precautions in the use of an anesthetic are required and the operation is one which should properly be carried out only by a surgeon especially interested and skilled in the treatment of thoracic cases.

MEDIASTINAL FLUTTER.

In performing operations for the cure of chronic empyema in the presence of a fixed lung and a fixed mediastinum the danger of collapse of the lung and of mediastinal flutter are absent; also, in the great majority of cases of pulmonary abscess, adhesions are present between the visceral and parietal pleurae which make it unnecessary to take special precautions to prevent collapse of the lung when the thoracic cavity is opened. On the other hand, when the chest is widely opened, in the absence of adhesions between the two pleural layers, and in the presence of a normal mediastinum, there is grave danger of collapse of the lung on the operated side and also of the lung on the unoperated side. In addition, displacement of the mediastinum may be followed with serious, and perhaps fatal, interference with proper heart action.

In a certain proportion of cases, moreover, a phenomenon is induced which is known as mediastinal flutter. In consequence of the embarrassment of respiration, the respiratory effort becomes rapid and shallow, and with each attempt to fill the lungs with air, the mediastinum flaps back and forth. Since in a large proportion of those cases, in whom open thoracotomy accompanied by use of an intercostal incision and a rib spreader, or by other means, is necessary, the vital capacity is very small and may even approach the tidal air, and the loss of pulmonary function in consequence of collapse may be extremely serious, and unless the proper precautions are taken, may well be fatal.

Those of you, who had the opportunity and privilege of serving in the operating rooms at the Clearing Stations or in the Field Ambulance dressing stations during the war, will readily recollect, in the first place, the awful appearance of the wounded soldiers suffering from open chest wounds. You will remember the blanched, cyanosed, anxious, panic-stricken appearance of these cases. You will also remember how quickly, and, in many cases, how completely all the above mentioned phenomena were arrested by such a simple procedure as the application of an adhesive plaster patch over the sucking wound.

The fact, however, that relatively large wounds were thus borne for several hours without death of the wounded soldier, and the fact that it was possible to perform extensive thoracotomies for the removal of projectiles imbedded in the lung, induced a certain number of observers to believe, and to state their opinions in public, that special methods of differential pressure were not necessary when the thorax was to be widely opened.

These observations were in complete contradiction to views which had been previously held, by practically all surgeons. It has been proven beyond a doubt since the war that, although in patients whose vital capacity is high and whose cardiac reserve is great, comparatively large openings can be made in the chest wall with relatively little respiratory embarrassment, such is not the case if the contrary condition holds. Since in civil life, it is unusual to operate upon the chests of young, healthy, adult males, as the soldier almost invariably was, it is not proper to assume, without definite proof, either high cardiac reserve or high vital capacity.

DIFFERENTIAL PRESSURE.

When operations are performed in which it is necessary to open the chest wall in cases in which adhesions between the pleural surfaces can not be assumed to be present, or in which wide exposure of the thoracic cavity with separation of adhesions is to be carried out, it is a safe rule to always have available some method of obtaining differential pressure.

There are four possible methods of obtaining differential pressure during the administration of an anesthetic:—(1) Sauerbruch's negative pressure chamber; (2) intratracheal insufflation (Meltzer-Auer); (3) pharyngeal insufflation, and (4) the mask of an ordinary gas-oxygen machine, when fastened snugly to the face, works satisfactorily.

When a normal pleural cavity is opened wide, as in exploration, if no form of differential pressure anesthesia is employed, the consequent collapse of the lung may reduce the respiratory area too quickly. It must be borne in mind that the great majority of patients requiring intrathoracic interference are suffering from a definite diminution in vital capacity. Also there may be a fluttering of the mediastinum. This flapping back and forth of the mediastinum may cause very serious deleterious effects upon the heart, great vessels and nerves. A further reason for maintaining expansion of the lung during operations upon this organ is that it is much more easily handled and, if, as frequently happens, it is necessary to suture the lung to the chest wall, differential pressure makes this a very simple procedure.

Sauerbruch's negative pressure chamber is an extremely expensive apparatus, and although its use is apparently a valuable procedure, it has never been generally employed. Intratracheal insufflation is

a method for the administration of ether, the value of which cannot be too highly estimated. By means of this method, collapse of the exposed lung can be completely avoided. If a certain amount of collapse is desirable, this is readily obtained by diminution in pressure and in such cases on the completion of operation it is a simple matter to re-expand the lung. In the performance of the operation of decortication, however, I have not found it possible to bring about distention of the compressed lung with reasonable pressures by means of intratracheal insufflation. The intrapulmonary pressure developed during coughing is of considerably greater value. In the performance of all operations, therefore, in which the lung tissue is apt to be incised or resected, I believe intratracheal anesthesia to be the method of choice.

Pharyngeal insufflation is comparable to intratracheal pressure anesthesia, but I believe has no advantages over the latter, and is less adequate.

As indicated above, a sufficient amount of pressure can be maintained within the lung by means of a snugly fitting mask in the administration of nitrous oxid-oxygen as an anesthetic. By a certain number of surgeons, among them Whittemore, of the Massachusetts General Hospital, this method is preferred. It is, in any event, worth bearing in mind that in the absence of an easily available intratracheal apparatus or in an emergency, the gas-oxygen machine can be employed for this purpose.

115 STANLEY STREET.

RECTAL ANESTHESIA IN OBSTETRIC PRACTICE.

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The induction of anesthesia by means of the colonic absorption of ether is not a recent development of the art and science of relieving pain. The possibilities of such a method were considered shortly after the discovery of the anesthetic properties of ether, and were made the object of a considerable amount of experimental work carried out by Pirogoff as far back as 1847. The nature of this work, together with the story of numerous attempts of other early investigators to introduce vaporised ether into the colon, is well told in Gwathmey's work on *"Anesthesia."*

After a few years of trial this method fell into disuse owing to the damage done to the intestinal tract, and it was not until 1905, when Cunningham devised a new technic for administering ether with air as a vehicle, that rectal anesthesia was again taken into consideration by surgeons and anesthetists, some of whom found the new mixture of value in operations on the mouth, nose, throat and chest.

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This method, too, was found to be not unattended with danger to the patient, and as it required not only an elaborate and cumbersome apparatus, but also a specially trained anesthetist, the ether-air combination did not meet with general favor.

Accordingly, another vehicle for the ether had to be found, and, in 1913, Cunningham and Sutton instituted and successfully carried out a series of experiments in which oil replaced air as a vehicle for ether. The technic of administration worked out by these investigators was so modified, and the apparatus necessary for carrying out the technic so simplified that many surgeons adopted the method for use in selected cases. Since then it has been generally accepted as of value in an operative field somewhat restricted by the surgeons.

ETHER-OIL IN OBSTETRICS.

Obstetricians were not so ready to adopt the method. Ten years elapsed before Thaler and Hubel tried it, and about the same time Gwathmey, Donovan, O'Reagan and Cowan published a preliminary report on a series of experiments carried out with the idea of ultimately establishing a routine for the conduct of labor which would render it painless and which at the same time would be free from danger, simple in its application and suitable for administration either in the home or in the hospital.

The optimism of Gwathmey and his associates led me to undertake the supervision of a series of experiments along similar lines at the Burnside Lying-In Hospital, in Toronto. This work was carried out by Dr. W. A. Dafoe, the resident obstetrician, and although the number of cases treated was small, yet the observations on these have not been without significance and the conclusions drawn are worthy of consideration.

Forty-two cases in all were treated, the first sixteen of which followed the routine of Gwathmey, which was, *first,* a careful cleaning out of the large intestine by repeated enemas until the return was clear; *second,* the initial hypodermic injection of one-sixth to one-quarter of a grain of morphin sulphate dissolved in 2 cc. of a 25 per cent solution of chemically pure magnesium sulphate, given at a time when the pains were coming every three or four minutes and lasting thirty to sixty seconds, with the cervix dilated to about two and a half fingers; *third,* the rectal instillation of a solution of one and a half ounces of olive oil, two and a half ounces of ether, two drams of alcohol and ten grains of quinin hydrochlorid. This was administered one hour after the hypodermic injection.

In the next fifteen cases this method was modified to the extent of dropping the magnesium sulphate from the initial hypodermic solution and leaving out the quinin and alcohol from the rectal injection, at the same time increasing its amount to five ounces of a 70 to 75 per cent solution of ether in oil.

The remaining eleven cases were those in which labor was well advanced and the rectal instillation of the ether-oil mixture given alone.

We found it of advantage to make up the ether-oil mixture at the bedside just before administration, first warming the oil in a graduated container which was kept in a water bath at a little above body temperature. The ether was then added, and the solution was at once slowly injected into the rectum by means of a 50 cc. syringe attached to a medium sized catheter. This procedure, which was done with the patient in the Sims position, usually took from five to ten minutes to carry out, and during pains pressure was applied to the perineum by means of a sterile towel, in order to prevent the escape of any of the mixture. As the time required for some of the mixture to travel as far as the cecum is little more than two minutes, within that time the whole of the mucosa of the colon was brought into use as an absorbing surface, with the result that in a very short time the patient was anesthetised, and as a rule remembered little more than the first two or three pains following the instillation, until after the birth of the baby.

Observations and Results.

Careful observation in the first and second series of cases failed to reveal any difference in the effect of the two mixtures on either the duration of labor or the character of uterine contractions. In each case the strength of the contractions was slightly diminished at first, but after a short interval they regained their normal tone. In our experience, therefore, the addition of the quinin to the mixture was of no particular value, nor did the alcohol seem to play any important part.

What did appear to be of importance was the choice of the proper time for the administration of the drugs. If the treatment was started too early labor was delayed and the results were unsatisfactory. The patients who responded most readily were those who were willing to cooperate with the anesthetist and in whom the cervix was already being well taken up, with a dilatation of from two and a half to three fingers, contractions coming regularly every three or four minutes and lasting at least thirty seconds.

We found, however, that in a large majority of the cases, in spite of a repetition of the magnesium sulphate when the effects of the anesthetic began to wear off it was necessary to use a small quantity of C.-E. mixture by mouth as the head was being born. We also found that a large proportion of both series vomited during the third stage, and became decidedly restless at the same time.

An analysis of the forty-two cases shows that twenty-six were primiparous and sixteen were multiparous.

Thirty-seven presented by the vertex and three by the breech while two were twin pregnancies. Of the thirty-seven vertex presentations thirty-two were L. O. A. and five R. O. P.

In thirty-one cases both hypodermic and rectal instillations were given.

In eleven cases rectal instillation alone was given. The instillation was repeated once in three cases and twice in three cases.

The hypodermic was repeated once in six cases, twice in five cases and three times in three cases.

The average length of labor in the primiparae was sixteen hours, while in the multiparae it was thirteen hours.

Eighteen patients went to sleep within eight minutes of the instillation and remembered nothing until some time after the completion of the third stage.

Twenty-two required inhalations of C.-E. mixture towards the end of the second stage, and of these eight were greatly excited during the early stage. In all of them, however, the recollection of the labor was indistinct and its length considerably shortened.

Two cases were entirely unsatisfactory, one because the preliminary cleansing of the colon was not properly carried out and the anesthetic expelled, and the other probably because of the early administration of hyoscin along with the morphin.

Nausea and vomiting were noted in thirty cases, but in none was there any evidence of irritation of the colon either during or after labor, and the condition of the mother was good in every case.

Of the babies thirty-eight were in good condition, one was fair, one lethargic and two stillborn. Regarding the latter two, in one the fetal heart could not be heard after the initial dose of morphin and magnesium sulphate, while in the other, which was an eight month baby, the fetal heart showed distress during a short second stage, seven hours after the rectal instillation and four hours after the administration of a half cc. of pituitrin.

Conclusions.

1. The method is unsuited to cases outside of a hospital.
2. It requires for the patient continued attention on the part of both obstetrician and nurse.
3. It is accompanied by nausea and vomiting in over sixty per cent of the cases.
4. It must be supplemented by inhalation of C.-E. mixture toward the end of the second stage in the majority of cases.
5. It is of value in the latter part of the first stage, through the greater part of the second stage and in prolonged labor.
6. It produces analgesia and an amnesia which generally lasts through the period of nausea and vomiting.
7. It is not without danger to the child.

100 College Street.

ACUTE HALLUCINOSIS AFTER OPERATION AND ANESTHESIA.

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The psychoses following surgical operations are probably next to secondary hemorrhage, the most important of all the various conditions which may appear as later complications of major operative procedures. They are especially tragic if consequent upon minor operations. To operate upon certain individuals without heed as to the mental complications may be no less than criminal. How then are we to recognize these individuals that we may prevent postoperative mental aberrations and how best treat them after they become manifest.

The type of psychosis which is peculiar to postoperative convalescence is notable in that auditory and visual hallucinations play the principal roles. One might classify these states etiologically under three headings: (1). Hallucinoses occurring in supposedly healthy individuals. (2). Hallucinoses occurring in those of low nerve reserve, the extremely fatigued or exhausted; or who have been victims of unrecognized mental and nervous entities—the so-called psychopathically endowed. These persons are often victims of a low grade toxemia. (3). Hallucinoses in those with endocrine disturbance or upon whom operative procedures involving the endocrine organs are contemplated.

PREDISPOSING FACTORS, AND PREVENTION

Old age as a predisposing factor is important. Hypotension, cerebral sclerosis, and cardio-renal lesions, resultant in younger and middle aged individuals from disease, are met in the senile as a natural consequence to age itself and make the elderly individual especially susceptible to mental shock and aberration.

If *previous mental unbalance* exists as in unsuspected paresis, paranoid trends, or maniac depressive states, the typical features of these conditions may present themselves as postoperative psychoses.

Acute hallucinoses are by no means the only features although they are often the predominate symptoms. The clinical picture may be grouped usually under two principal headings. Acute mania and an acute toxic delusional state with or without psychomotor activity. Can we attribute blame to any one factor for the development of postoperative psychoses? Does it follow ether anesthesia more often than gas or does it manifest itself more commonly following operations under local anesthesia? In other words can we do anything to avoid its occurence?

We may view the situation from two standpoints: (1). the psychologic; and (2) the standpoint of actual pathologic lesions either present, or developing postoperatively directly or indirectly consequent to medication or the anesthesia employed.

Psychiatrists often maintain that any acute psychosis developing after great emotional shock or strain presupposes a so-called *psychopathic personality* in that individual. In other words the perfectly poised individuals, those not psychopathically endowed, are immune to acute mental aberration from nervous shock alone. The period of adolescence and the climacteric are well established periods of mental instability.

Fatigue and potential exhaustive states must be considered as important underlying etiologic factors, these elements fertilizing the soil as it were, for the seeds of shock, fear, changed environment, elaborate hospital routine, especially in the aged. With psychoses developing in all walks of life, as the result of the increasing complexity of modern civilization, there is little wonder, surely that mental aberration does not more often follow operations. Every person has what has well been termed a *symptom level of nerve tone.* It is well to keep this factor in mind in taking our case histories to determine the mental and nervous status of prospective operative cases.

The aged person, like a child, is affected to an exaggerated degree by each slight change in his or her environment. Give an old man such a shock as a change of place and persons, together with the elaborate detail of modern hospitals as a constant environment, and it is not to be wondered that he will seek that mental seclusiveness which gives him his only relief. He will eliminate his immediate surroundings from the personality and find comfort, so to speak, in his auditory and visual hallucinations. The casual observer will report him as confused, and indeed he is. He calls for his friends, rises at night from his bed in search of familiar faces and objects.

The convalescence is sometimes gravely impaired by such a complication. The condition interfers especially with rest at night. Various phobias may develop, keeping the patient in a state of almost constant fear. He may even develop low-grade persecutory delusions, distrusting those about him, doubting their good intentions. There is sometimes a complete change of personality, during which time there are but a few lucid moments each day, with sufficient insight into his condition as to alarm him increasingly. Usually, however, the affair simulates dream states; a *confusional delirium unassociated with fever.* One might well classify the malady under the head of *exhaustion psychosis.* However, we feel that while fatigue is undoubtedly an important factor it simply furnishes the back-

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ground for a clinical picture of which many other factors are very necessary elements—strange faces, unusual noises, fixed position with eyes gazing at a blank ceiling, all these, *plus fatigue*, disorient the senile mind.

Such an acute hallucinosis is by no means a slight matter. It is likely to result rather promptly in nutritional disturbances, which, in a patient already reduced in vitality, may lead to a fatality. If the psychosis is of the agitated type, the consequent loss of rest and sleep will bring about complete exhaustion if unrelieved within a few days. Continuous cerbration with refusal to take food, particularly liquids, is obviously of serious import.

Early Return Home.

To the end that orientation may be re-established it seems prudent to arrange that patients after operation receive frequent visits from immediate relatives. Permitting the wife or a grown-up son or daughter to remain at all times in the patient's room has occasionally served to prevent such an old individual from becoming lost mentally, or to bring him back to a rational state after aberration had become manifest. Not infrequently, however, the simple expedient of asking the wife to sit at the patient's bedside has not sufficed to correct the disorientation. In such instances we have found that to send the patient home in an ambulance is a truly life-saving measure. Almost invariably such confused, sleepless old people return to a quite rational state of mind upon reaching home with its familiar faces, voices and long known objects of all kinds, animate and inanimate. Nurses accompanying such patients to their homes, have recorded interesting and sometimes amusing instances of rather sudden return to a normal state of mind as a result of the patient hearing the familiar bark of the old house dog, the clearing away of the confusion, upon recognition of the farm house and barn, a stile or gate, or a farm implement standing in the field, a tree or a many times traveled lane. The reason for this is, of course, not far to seek; these objects serve as guide posts to turn the mental processes into their normal channels.

It is in the belief that this simple but very helpful expedient may have been overlooked by surgeons, perhaps to some extent because of its very simplicity, that the foregoing report is submitted. We believe that we have been able to save a number of elderly individuals from fatal exhaustion by sending them home in an ambulance or by train, even in cases where the distance was one hundred miles or more.

Admitting that in practically every instance the conditions in the home would not be favorable for proper care of the wound, the step is nevertheless advisable at times for the reason that the disordered mental condition may and often does represent the most serious, if not the only cause for anxiety as to the outcome of the case.

We are aware of the fact that this is contrary to the usual custom of treating mental disorders. Maniac depressive insanity, incipient dementia precox cases and even senile dementia are best treated in institutions where they are absolutely isolated from home surroundings and relatives. It must be remembered, however, that these types are insidious in their onset, many weeks, months or even years elapsing before the condition is recognized. Even exhaustion psychoses developing in the home consequent to chronic wasting disease or following typhoid clear up more satisfactorily with institutional care.

The new environment is helpful to individuals representative of these types awakening a new interest in themselves and others. Whereas the treatment of the peculiar psychosis developing postoperatively in elderly individuals, as already related, is an exception to the usual custom; although really the method is the same; *namely* that of changing the environment. The gratifying recovery following this simple expedient of sending the patient home is the phase of the matter we wish especially to emphasize. The obvious solution often goes unrecognized because of its simplicity. And so in the handling of this peculiar mental derangement, the surgeon may avail himself of a simple, satisfactory remedy for what otherwise might prove a quite baffling problem, should he be inclined to procrastinate.

Dr. C. W. Sawyer of Marion, Ohio, in 1921, cautioned the profession against the careless and wholesale extraction of teeth, giving many case histories illustrative of the hazards of postoperative psychoses. Presumably his observations were confined to work under local anesthesia. He especially emphasizes the liberation of toxins after teeth extractions as a great etiological factor and pleads for the diagnosis of constitutional defective states before operation. He advises the step by step method of extraction.

The work of Dr. Howard D. McIntyre, of Cincinnati, Ohio, on the relation of the autonomic nervous system to mental depression is interesting in this connection. He states that vagotonia is often coincidental with mental depression and that atropin will often be of temporary benefit. Very interesting also is his statement that the depth of the depression varied directly with the severity of the vagotonia. He classes cases as vagotonic in which there is a fall in systolic blood pressure of over 20 Mg.Hg. on deep inspiration. In cases in which the drop of blood pressure was complete with no compensation on the part of the sympathetic nervous system the mental depression was most pronounced. He states the evidence bears out the idea of William James concerning the emotions:—The

emotions are highly complex sensations for which the visceral and other bodily changes supply the afferent stimulations.

Dr. Thomas E. Satterthwaite, of New York, corroborates the work of Dr. McIntyre in his study of arterial blood pressure with reference to clinical values. He states that for the most part hypotension indicates mathematically the degree of exhaustion that exists in wasting diseases. If the hypotension is due to adrenalin insufficiency he advises dried thyroid gland extract, which medication, according to Wilson, enhances the power of adrenalin in the blood stream 300 per cent.

Effects of Anesthetics.

We have noted the relative frequency of postoperative psychosis after local anesthesia as compared to ether. We have had no experience with mental abberration following gas-oxygen for the reason that we employ very little nitrous oxid. Almost invariably we have noticed a temporary amnesia following the use of novocain. There seems to be a general mental confusion; a disorientation as to time, place and persons; evidenced more particularly in elderly subjects. Rarely do these individuals later recall having been taken from the surgery. However these symptoms are usually fleeting in nature, the mentality clearing in the course of a few hours time. Their appearance seemingly has nothing to do with the amount of novocain used, much less than the so-called maximum amount for safety—40 cc. of a 1 per cent solution per kilogram body weight—usually being employed. It would seem that it is clinically advisable, as well as theoretically justifiable from the previously quoted work of Wilson, that the use of adrenalin along with the injection of novocain be abandoned in the toxic thyroid cases.

Conclusions.

In conclusion we would suggest the following:

1. Thorough hospitalization of patients before operation to acquaint them with hospital routine and attendants; thus minimizing the element of fear. In selected cases also to allow a near relative to remain at all times in the patients room.

2. Carefully taken histories with due psychiatric consideration. The early diagnosis of potential nervous exhaustion by the determination of vagotonia and especially the presence of hypotension.

3. A studious cardio-renal examination including kidney function tests in addition to the usual preoperative urinalyses.

4. The sending home of all cases of mental aberration in which the appropriate use of atropin, adrenalin or thyroid extract gives no immediate relief. This to be done as soon as possible that proper orientation may be facilitated by familiar sounds, faces and scenes.

5. The bearing in mind also that the periods of adolescence, the climacteric and senility are times of especial mental and nervous instability, and that individuals, presenting themselves for operation, at these periods are deserving of the most careful handling.

331 No. Delaware St.

GENERAL ANESTHESIA FROM THE HOSPITAL STANDPOINT.*

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When asked by our secretary to present a paper on this topic, I told him that I had written on this subject some time ago, and that I would quote liberally from that article.

I will present the subject as follows:—

1. Anesthetics and Methods of Administration.
2. Who should Administer Anesthetics? The pre-requisite requirements.
3. The Staff Member as the Anesthetist.
4. The Interne as the Anesthetist.
5. The Trained Nurse as the Anesthetist.

1. Anesthetics and Methods of Administration

(A) *Nitrous Oxid-Oxygen*—No modern hospital can consider its anesthesia department complete without suitable provisions for the administration of nitrous oxid-oxygen, with or without ether. The advantages resulting from its use are many. The induction is rapid and very pleasant; it is safe; recovery is rapid; there is little or no irritation of any of the viscera; the after-effects are greatly diminished or absent; and complications are reduced to a minimum.

Hospitals sometimes consider the advisability of manufacturing their own supply of nitrous oxid and also oxygen. After serious consideration, and conference with hospitals who do manufacture their own, I have come to the conclusion that it is more satisfactory and convenient to buy the supply from reliable manufacturers, even when the amount used is a large item.

The apparatus for the administration of gas-oxygen to be used in a given hospital will depend on the choice of the attending anesthetist; he has any number of different makes to choose from, each with certain advantages and disadvantages. I do not believe it is a matter of great importance which of these is chosen. One anesthetist will have a satisfactory administration with the apparatus which he is accustomed to use, while another will use a very different type of apparatus and get the same results. (In other words it is a question of familiarity with the apparatus in use and a knowledge of the action of the anesthetics given.) I prefer an apparatus which is so equipped that, when necess-

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ary, ether can be added drop by drop,—as in the Coburn instrument.

(B) *Insufflation Anesthesia*—In operations on the head, neck, or within the chest, it is generally recognized that the most satisfactory method of anesthesia is by means of insufflation. In head and neck surgery the anesthetist is kept out of the sterile operative field. In operations in and about the mouth and nose, which would otherwise require the intermittent use of the mask, it gives a continuous flow of the anesthetic and is, therefore, ideal. In chest work, it keeps the lungs inflated when necessary.

This method requires an apparatus, preferably motor-driven, which will deliver air under regulated pressure; this air, by means of proper connecting tubes, is then made to pass partially or completely through a bottle containing the anesthetic (ether or rarely chloroform) and from here by tube into the trachea, pharynx, or buccal cavity.

The ideal apparatus for this purpose is the Konnel Anesthetometer; and instrument which delivers automatically "a known volume of accurately measured percentage of ether vapor" evenly throughout the administration. This apparatus is not in general use because of its expense. There are, however, quite a number of moderate priced instruments on the market, which are very practical for insufflation purposes. A good many of these are so arranged, that in addition to the insufflation there is an extra attachment for suction; this is nowadays considered indispensable in most of the nose and throat operations.

(C) *Ether-Oil Colonic Anesthesia*—We all owe a debt of gratitude to Gwathmey for perfecting this method of giving ether per rectum. I have found it invaluable in cases which would otherwise have been very troublesome for general anesthesia. *For example,* laryngectomies; extensive dissections of the throat, as for carcinoma; removal of the superior or inferior maxilla for malignancy; amputations of the tongue, and many others. I have also frequently used it for thyroidectomies. I will not go into detail here of the technic of the administration except to say that I follow more or less the procedure of Gwathmey—never using more than 135 c. c. of ether. When the steps in the preparation of the patient are carefully followed the anesthesia resulting is uniformly ideal.

(D) *The Open Method*—While a few of the large clinics still use the so-called open method of ether administration, exclusively, (really a semi-closed method) most of the hospitals now use the closed method. However, the open mask should be part of the equipment of every operating room. It is best, for short operations on infants and very small children; in some of the obese subjects, especially those with wheezy chests, cyanosis, or very marked arteriosclerosis, who do not as a rule stand the closed mask well; also whenever chloroform or ethyl chlorid is indicated. In patients with abscesses of the floor of the mouth or deep seated abscesses of the neck(*for example,* Ludwig's Angina or infections resembling it) I have found the closed method of anesthesia extremely dangerous. The open mask method with a large amount of air will be found much safer in these cases. Internes who are just beginning their anesthesia course should first learn the open method. The mask most commonly used is the Yankauer mask.

As part of the general requirements it is necessary for the anesthetist to be provided with a suitable table or tray equipped with a blood pressure apparatus, mouth gag, tongue forceps, breathing tube and anesthesia chart.

(E) *Ethylene*—Although extremely interested in any new general anesthetic, I have thus far refrained from using ethylene, feeling that the advantages claimed for it did not sufficiently counterbalance the dangers connected with its use. It so happens that in some of the hospitals where I work, the cautery is frequently used; very often several times in the course of a morning or afternoon. In many thousand anesthesias in the past fifteen years, under these conditions, I have never had any explosion with ether or with nitrous oxid-oxygen. Of course, the usual precautions are taken not to bring the cautery near the head of the table. Notwithstanding the statements which have appeared to the contrary, I believe, therefore, that ether is much safer than ethylene.

In addition to this, it has been my good fortune, I suppose, to work with surgeons who did not insist on extreme relaxation, and who were willing to accomodate themselves to a certain amount of rigidity, when the condition of the patient did not warrant extreme degrees of relaxation,—which to my mind of necessity includes relaxation and loss of tone of an already overburdened cardiac muscle. I, therefore, have had quite satisfactory service from nitrous-oxid-oxygen with small amounts of ether when necessary.

Another point against the use of ethylene is the unpleasant odor. Physicians and attendants in operating rooms where ethylene is used, have complained to me about the unpleasant odor which permeates the operating room and gives rise to frequent headache.

2. WHO SHOULD ADMINISTER ANESTHETICS? THE PREREQUISITE REQUIREMENTS.

I believe that it is absolutely essential for the anesthetist to be a physician, one who combines a general knowledge of medicine with a specialized knowledge of anesthesia. A general knowledge of medicine is indispensible for a thorough understanding of the following:--(a) The physiology and

pathology of the heart and blood vessels, lungs, kidneys and other viscera. (b) Metabolism and its diseases,—diabetes is especially important as diabetics are poor anesthetic risks, (c) Acid intoxication, the action of anesthetics in inducing acidosis or aggravating it when already present, and the means of combatting this condition. (d) Shock,—its nature, causation, early manifestations, degree present, prevention and treatment. (e) Various reflexes and their interpretation. (f) The choice of anesthetic in a doubtful case and the depth to be maintained. (g) The question of preliminary medication; the amount and the recognition of idiocyncrasy.

In all these instances a general knowledge of medicine makes it possible for the anesthetist to exercise his judgment for the welfare of the patient. The anesthetist's opinion of the patient's condition is helpful to the surgeon during the operation, and in recommending preoperative and postoperative care. The surgeon who works with a trained medical anesthetist comes to rely upon his judgment as an important factor in the welfare of the patient.

It is also essential to know the physical properties and the physiological action of the various anesthetics used and their individual indications and contraindications.

3. The Staff Member as the Anesthetist.

Large hospitals, especially, have begun to recognize the need of visiting anesthetists with assistants when necessary. Physicians who devote their time exclusively to the subject of anesthesia. This work is of such importance that it should be accorded a department of its own, with an established head, who shall have a position on the medical board in the same capacity as the heads of the other departments. The duties of the visiting anesthetists should include the practical instruction of the internes who are assigned to the anesthesia service; instruction in the use of the various methods of administration already outlined; the proper care and selection of the agents, their properties, the advantages and disadvantages of each; the importance of blood pressure readings and the early recognition of shock; the preoperative and postoperative care and treatment; the care of the various apparatus and methods of sterilization; as well as the necessity of careful records of all anesthesias.

The staff members supervise the internes during routine work. Where necessary, however, in serious and difficult cases, one of them administers the anesthetic himself.

4. The Interne as the Anesthetist

At the present time the system of medical education is such that the student receives very little theoretical, and little, if any practical instruction in anesthesia. The hospital, therefore, should afford every interne the opportunity to supply this need in a regular course of anesthesia of four to six months duration, during which time he gives all the routine anesthesias under supervision by the staff anesthetist. It is advisable to have more than one interne on each service, do this work during the same period, so that they can relieve each other. The best time for the interne to get this instruction, when the term of service permits, is during the second half of his first year's stay at the hospital. By that time he will have received a more practical knowledge of the physiological and pathological conditions of the various organs, and will, therefore, be more ably equipped for this course.

I understand that the College of Surgeons requires hospitals to give a course of instruction in anesthesia to their internes. Where nurse anesthetists are employed for the routine anesthesias, there is no opportunity for practical instruction afforded the internes. So that in such institutions, the interne may receive a few theoretical lectures and possibly a few practical demonstrations in order to comply with the College requirement. This, however, certainly does not comply with the spirit intended in this request.

5. The Trained Nurse as the Anesthetist

Considering pre-requisites mentioned, I maintain that a nurse is *not* fully competent to administer anesthetics. She may be trained in the technical processes of the administration, and may even have had a few months instruction in physical diagnosis, such as is given in some of the hospitals training nurses for anesthesia. (I do not believe that anybody without a full study of medicine can properly interpret signs brought out by physical diagnosis). But this, at best, can give her only a superficial experience, and does not prepare her to meet the conditions with the matured judgment which can only come through a thorough knowledge of medicine. She is no more qualified to do the work of an anesthetist, than a nurse with an operating room training and a superficial knowledge of anatomy and the mechanical skill which has enabled her to master the steps necessary to open an abdomen and remove an appendix, *for example,* would be qualified to do the work of a surgeon. The matured judgment which comes only with the general knowledge of medicine is wanting in both cases. The fact that nurses do administer anesthetics in a few of the large clinics in this country, is by no means a proof that it is a good thing either for the patient or for the institution. Indeed, a hospital which entrusts work of this nature to a nurse, assumes a grave responsibility.

Justice to patients demands that they be served with the utmost skill, not only in the mechanical administration of the anesthetic, but with the abil-

ity to cope with any emergency which may arise during the anesthesia.

Surgeons and hospitals should also look at this question from the broader point of view. Let them consider the tremendous advances in the science and art of anesthesia in the past twenty years, and the extensive research in this field today. This work has been done, and is being carried on at present, by conscientious physicians who are giving up their entire time to this work. If the nurse anesthetist should become an established fact, and become general in *all* hospitals, it seems to me that this will certainly not encourage such men to devote their energies in a field where they are practically put into competition with nurses. We surely do not expect any advances in the science from the nurses themselves. We must remember that the internes of today are our anesthetists of tomorrow. If the nurse anesthetist is established in all hospitals, aside from the fact that the internes will be deprived of the practical training, it will certainly not encourage them to specialize in anesthesia.

Would the hospitals and the surgeons, therefore, like to see the time when there are no physician anesthetists? Some surgeons, I imagine, would welcome such a state of affairs as for example, Dr. J. F. Baldwin, of Columbus, Ohio.

Before closing, I would like to take a few minutes more of your time for the consideration of an article which recently appeared,[2] which is really a plea for the nurse anesthetist.

I have not seen any comment in answer to this paper as yet, and since it was given space in the columns of the American Journal of Surgery, which prints papers from the transactions of some of our anesthesia societies, including this one, I feel that it should not remain unanswered. I refer to an article entitled "Anesthesia Deaths, Some Avoidable Causes," by Dr. J. F. Baldwin, of Columbus, Ohio. I consider this a most unjust, unwarranted, scurrilous attack upon a conscientious body of physicians.

Let us consider first the report of some of the fatalities. Without going into full detail of each one, I will just call your attention to some of the facts brought out. I think that they speak for themselves.

CASE 1.—*"Anesthetist—a recent graduate. A. C. E. mixture used. Death took place toward close of the operation, but was not recognized until the patient was returned to the ward."* It seems to me that even if the anesthetist was as incompetent as all this, the surgeon or the others in the operating room might have discovered that the patient was doing badly or had died long before she reached the ward.

CASE 2.—*"Chloroform used as freely as though it had been ether. Patient died on the table, but her death was not recognized until I stood up and saw her face."* The doctor does not tell us why chloroform was used, and why was it used in the manner stated.

CASE 3.—*"Chloroform used by preference by her family physician. Operation, an appendectomy, occupied ten minutes; at the completion, patient found dead, much to the surprise of the anesthetist who had not discovered the fact."* Again, why was chloroform used, and why given by the family physician?

CASE 5.—*"Young male patient, etherized by physician who paid special attention to anesthetics. Without any necessity or warning, he suddenly poured onto the mask an uncertain amount of chloroform. Patient took one breath and was dead".* What anesthetist(?) would use chloroform in this manner?

CASE 6.—*"Death from overdose of ethyl bromid".*

CASE 7.—*"Death from overdose of ethyl chlorid, both given by a 'specialist.'"*

CASE 8.—Is rather interesting. *"Young boy operated for mastoid disease, under chloroform by family physician with quite a large experience in anesthetics. The anesthetist was automatically pouring chloroform on the mask while paying no attention to the patient, but watching operation closely. Patient had evidently been dead for some minutes before it was discovered."* I have never seen or heard of any physician worthy of the name, using chloroform in this way.

CASE 9.—Does not give the anesthetic used. *"At the conclusion of the operation, in an elderly woman, who was a bad risk, patient was found dead, but the anesthetist had been a spectator, and had not recognized the fatality.*

CASE 10.—*"Anesthetized for thorough abdominal examination by her attending physician, who gave her chloroform. The examination was completed quickly, but on returning to the side of the bed after washing my hands, I found the patient dead, greatly to the surprise of the anesthetist, who was paying no attention to her."*

One fact that is brought forward in the statement of these fatalities, and for which the doctor should receive due credit, is his ability to recognize death long before the anesthetists he works with—but too late to be of any value to the patients.

Dr. Baldwin says,—"With the nurse anesthetist, I have had no deaths. She watches the patient closely; the breathing, pulse, color are all carefully and continuously under observation." I think I can safely say that every medical anesthetist outside of Dr. Baldwin's acquaintances does at least that much.

Dr. Baldwin also says,—"Except on special occasions and for special reasons, ether has been given by the open drop method, and always without any machinery." In other words, he does not allow the use of nitrous oxid-oxygen since the report of a number of deaths from its use.

Considered as a whole, instead of this report of deaths being an indictment of the medical anesthetist, does it not prove gross (I might say almost criminal) negligence on the part of the hospital and surgeon concerned, in allowing such careless and incompetent men to be trusted with human life. Men who undertake to administer anesthetics and who have no knowledge of our modern and newer methods of anesthesia, who do not watch pulse, respiration, color or other important phenomena under anesthesia. I might also add that without any reflection intended on the family physician, it is not common practice in modern hospitals and among *good* surgeons to allow the family doctor to administer anesthetics.

Dr. Baldwin says further,—"The employment of nurses to administer anesthesia is not a question of commercialism, but one of service. In my opin-

ion, commercialism is the important consideration from two poionts of view, *namely*:—the hospitals and the postgraduate institutions who give the courses of instruction to nurses.

To the hospitals, the income from this source is an important factor in a majority of instances. I know that in some of these hospitals this is being done as a simple means of greatly increasing the income from the patients. (*For example*, the hospital pays the nurse anesthetist a salary of, let us say, $125 to $150 a month with maintenance. The hospital makes a minimum anesthesia charge to every patient of $10 to $15. There will be at least 50 to 75 cases per month for every nurse so employed. Financially, it is surely a profitable procedure for the hospital). In fact, in some of these institutions, when a patient demands an outside specialist in anesthesia, the patient is penalized for making this request by making him pay the routine anesthesia fee anyway.

Th postgraduate hospitals giving these courses charge a substantial tuition fee, and when a large number of nurses take this course, the income becomes an important factor to be considered. In order to stimulate the interest of the nurses in this new field, they must be more or less assured of being placed, and the demand for them must be created. This is done by these schools by extensive propaganda carried on in various ways, to interest the hospitals in this new idea.

Dr. Baldwin also says,—"At the present time the demand for physicians, particularly in the smaller communities, is much greater than the supply, and undoubtedly many a lazy, incompetent and single-track doctor, who is now making an easy living as an anesthetist, would become a useful member of the profession and the community if he returned to general practice."

If there really are such doctors practicing anesthesia, I agree with Dr. Baldwin that they should be relegated to the backwoods; but if there is a problem of supplying the needs of rural communities with general practitioners, why not draw from a much larger source: I mean from the surgeons, both from those doing general surgery, and from those in the various special branches of surgery, (including those in the present especially lucrative field of nose and throat surgery), a goodly number of whom are incompetent, do a lot more harm than good, and who could easily be spared by the profession and the community, for this purpose.

Finally Dr. Baldwin says:—"I have great dread of the cock-sure specialist who has allowed familiarity to breed contempt, and who becomes as a result, dangerously careless in watching the patient and indifferent as to the amount of anesthetic used." In my opinion, the longer the specialist is in practice and the larger his experience, the more careful he becomes both in his choice and the amount of anesthetic used, and in his watchfulness of the patients confided to his care.

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PREPARATION OF THE BAD SURGICAL RISK FOR OPERATION.

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Under this title are meant to be included those cases which are regarded as bad surgical risks, for the reason that some of the vital factors of the body are at such low ebb that they must be specially conserved in order to make any surgical operation reasonably safe. It is also intended that those cases should be included where both the surgeon and the patient are willing to undergo the risk incidental to operation, in order to derive whatever small chance for recovery may be offered by such procedure. It is also meant to include those cases which, without surgery, have no chances for recovery. We will consider:—

(1) Cases in which the serious element has to do with the condition of the heart and circulatory system.

(2) Cases in which surgical risk is augmented by the condition of the kidneys.

(3) Septic processes in all types associated with toxic systemic changes due to peritonitis, empyema, or any general septic condition.

(4) Cases associated with disturbances in the respiratory system, which make operation especially dangerous.

(5) Conditions associated with hemorrhage in any of its aspects.

(6) Abdominal conditions associated with either cancer or peritonitis, in any of their various forms.

(7) Starvation.

Preparation depends, first, upon whether we have a few hours, a few days or a few weeks in which to prepare our cases for surgical shock. The element of time is one of ultra importance, realizing that unless we have time, we can do but little for many of these cases; realizing, too, that there is a certain group of cases that are absolutely beyond our ability to restore to a condition sufficiently normal to permit of any type of general anesthetic operation.

HEART CONDITIONS.

Failure of compensation, with heart leak, is difficult to combat, and if it can be relieved at all, requires time—perhaps even weeks or months. Per-

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haps the two factors most to be considered are, first, the restoration of the heart muscle to a point where it can function under a certain degree of abnormal load; and secondly, to be able to keep the body fluids up to a point where each contraction of the heart will throw out something near its normal volume of food to the tissues. A heart fully compensated, even in the presence of a leak, will tolerate ether very well.

KIDNEY CONDITIONS.

Exactly the same conditions holds true with reference to kidney function as has been mentioned in connection with heart conditions. Here again, in cases where the kidney function has been reduced to 25 per cent of normal, considerable time is necessary to restore the case to a point where surgical toleration may reasonably be expected. Diabetics stand operations well, take ether well, but the healing of the wound is always a question, because metabolism is so definitely disturbed that we never build great hope on these recoveries, unless we can have a considerable period of time for preparation, and can combat acidosis. The recent addition of "Insulin" to our armentarium will perhaps do much more for diabetes, where operation offers some hope of benefit for some concurrent or incidental disease.

SEPTIC PROCESSES.

Septic processes must be met first by keeping up nutrition. These cases are starved over a considerable period of time, due to gastric disturbances and poor assimilation. To these conditions must be added the load of carrying and eliminating enormous quantities of septic poison, without the tissues being supplied with anything near the normal amount of either food or fluids. Hence these septic conditions must be controlled by carrying to the tissues themselves the greatest possible amount of actual food products, and the cardio-vascular system must have and we must maintain a blood volume as nearly normal as can be maintained, in order that each contraction of the heart will carry fresh blood and fresh food to the already overtaxed cells. I feel sure that antistreptococcic serum, given subcutaneously in 20 cc. doses and repeated daily for from three to six days, has given benefit in a number of cases. Medicines by mouth may be continued with the same ordinary rules that govern general practice. Special attention should be devoted to keeping the tongue moist and the secretions reasonably active (this with special reference to the so-called internal secretions.)

Rectal feeding, as a means of introducing actual food, should rank second or third, believing as I do that intravenous medication, intravenous feeding and transfusion of blood are of far more value than are our efforts to bring about the absorption of food by the large bowel. The administration of hydrochloric acid in five-drop doses as frequently as the patient can take water—every two or three hours for two or three days—plus one-tenth grain of calomel three times a day, has given the best results in getting a dry tongue to remain moist.

PERITONITIS CASES.

Peritonitis cases represent perhaps our most rapidly fatal group of cases: rapidly fatal, for two reasons: *first,* the extensive toxemia associated with the condition, due to the enormous area covered by the peritoneum, and the toxic absorption therefrom; and *second,* the intestinal distention, causing a reduction in the blood supply to the intestinal wall, and in the arterial blood supply to the area with which to fight infection, greatly retarding the venous return flow, which is practically the only means of carrying away the infection.

Hence, if we can keep the distension down, if we can keep up the body fluids and the food, plus a reasonable drainage from the areas where pus has collected, we are employing about all the weapons we possess.

TOXIC GOITRE CASES.

Toxic goitre cases perhaps require the most mature judgment in their handling. Important factors consist of rest in bed, careful feeding, special attention to the heart—icebag over the heart, digitalis up to toleration, tincture of belladonna—plenty of fluids over whatever period may be necessary, gradually increasing the patient's power of resistance to a point where he can endure the insult incident to operation. The presence of histamin in the blood causes the capillaries to dilate so that the patient bleeds to death in his own vessels. This is made possible by the individual muscle cells in the capillary walls becoming smaller and the interspaces becoming larger, thus permitting the colloids to escape from the blood stream. This in turn causes the great hunger of the cells; hence, the exhaustion and shock. This chapter alone is of sufficient importance to form the subject matter of an entire paper.

ADMINISTRATION OF FLUIDS BEFORE OPERATION OR ANESTHETIC.

The administration of fluids can be carried out in several ways. First, the intravenous introduction of salt solution in quantities sufficient to carry on the normal functions and the normal water requirement of the body. If we stop for a moment to realize, we will find that 2½ pints of sweat, 3 pints of urine and perhaps another pint that goes out in respiration, only constitute a part of the normal body requirement of water alone in twenty-four hours. Hence, if we wish, we can introduce into the veins quantities of water certainly up to two or three thousand cc. per day with absolute safety.

Crile has said that the rectum alone will absorb anywhere up to ten pints of water in twenty-four

hours, so that we have this avenue through which to introduce fluids into the body. Again, we have the privilege of introducing medication with or without fluids in the form of adrenalin, or any other drug available for such use.

We now come to the so-called sugar products, or glucose, which can be given in percentages up to 10 certainly with safety, and in such quantities as would correspond to the normal daily carbohydrate requirement of the body. Then we have blood transfusion, by means of which we can actually introduce blood into the circulation as often as we desire, and in quantities up to 500 cc. for the adult at one dose and this can be repeated daily for a time, perhaps longer than any one of us now realize. Gibson's recently reported work at Crile's Clinic covering an experience of five years in blood transfusion work, states that during that time they had given something in excess of one thousand blood transfusions. To this work, plus the success they have obtained in keeping up the body fluids, the author attributes the reduction in their operative mortality from 4 per cent plus to 1 per cent plus. This procedure is now being favored rather extensively all over the country, and I am quite sure that we have sufficient evidence of its success to convince us of its actual value in reducing operative mortalities.

The importance of temperature cannot be overestimated. That we should cease operating (with the exception of emergencies) in extremely hot weather associated with humid atmosphere, there is no question. Goitre cases are especially unfavorable in very hot weather. On the other hand, cold operating rooms, having a temperature of 65 degrees or below, are equally dangerous. When it is possible to regulate the temperature of the operating room, the thermometer should register 80 degrees or more for all shock cases. In operating all high tension cases—high blood pressure cases, exophthalmic goitre cases, and others of similar type—the temperature of the operating room should be 70 degrees. When operating in the heated season, Crile has had some very good results from the use of ice in post-operative exophthalmic goitre cases.

Anesthesia.

With reference to the question of anesthesia, there is no doubt but that in most cases, other than those of the septic abdomen, a successful termination may be reached with the proper use of local anesthesia, when the use of a general anesthesia might turn the tide against us. However, I am quite sure, when the patient is properly prepared with reference to the up-keep of the fluid content of his body, he will tolerate a general anesthetic very well, and all abdominal cases, with the possible exception of the emergency enterostomy group, can be handled better under general than under local ansthesia. The anesthetic should be administered by a real anesthetist, who takes from the patient every possible ounce of load that can be removed, and sees to it that no factor is overlooked even for a single minute during the anesthesia. The anesthetist should remember to keep the throat clear and open, the chin always up, never allowing a patient to labor to inspire air.

Illustrative Case Reports.

I briefly report three cases—one occurring in 1911, one in 1915, and one in 1923—to illustrate that I have been carrying out these ideas for a number of years, simply adding an extra precaution here and there.

Case 1 (1911).—(This case has been previously reported to the Academy of Medicine, and the patient presented several times.) Mrs. B., aged 44; seen in November, 1911, at her home; diagnosis, gastric ulcer with obstruction, possibly carcinoma of the pylorus. Patient had been vomiting constantly for three weeks, and weight was less than 80 pounds. She was told to present herself at the hospital the next day, and an effort would be made to do something for her through the medium of surgical intervention. On Friday morning we gave her one quart of salt solution in the vein. On Saturday morning, we gave her another quart in the vein—all the fluid that the rectum would absorb by Murphy drip. On Sunday she had another quart and all the stomach would tolerate, and on Monday morning, we gave her the fourth quart in the vein immediately before operation, which consisted in taking out about one-third of her stomach, and doing an end-to-end anastomosis after the method of Billroth, No. 1. This patient lost less than a half-ounce of blood during her operation, never vomited afterwards, made a perfect convalescence, lived more than eight years, and died while I was in the army, her death being due to a possible secondary involvement of the liver.

Case 2 (1915).—This was a case of septic miscarriage, which came to the operating table depleted by having bled tremendously; she was carrying a temperature of from 103-104°, pulse of 140, respirations almost sighing in character. She was given 1500 cc. of salt solution and immediately cleaned out. She was given all the fluids the rectum would absorb for the next three days. She was also given 1500 cc. of salt solution intravenously each day for three days, in addition to one administration of 20 cc. of antistreptococcic serum daily for the same period of time. At the end of this time her convalescence was sufficiently established to allow her for the most part to take her own fluids.

Case 3 (1923).—A male, aged 38, seen in consultation with Dr. George Topmoeller, April 9, 1923. Diagnosis, ruptured gastric ulcer, made by

the attending physician, in which I concurred. Immediate operation at St. Mary's Hospital. Fifteen hundred cc. of salt solution was given this man before the anesthetic was started. Abdomen was opened by transverse incision, upper right side. Considerable quantity of stomach exudate found in the cavity; duodenum delivered, ruptured ulcer sutured and area patched with piece of omentum. Patient returned to bed in fair condition. Convalescence remained fair up to the tenth day, at which time he developed an obstruction of the pylorus. He also had extensive bleeding from what we supposed to be other ulcers in his stomach. At this time his condition became critical, and he vomited large quantities of very dark, degenerated blood (proven by laboratory test).

After careful consideration it was decided to prepare him for a posterior gastro-enterostomy, or resection of the pyloric end of the stomach. April 23, he was taken to the operating room in an almost moribund condition—so serious that the orderly left word that he would be up soon to take him down to the morgue. We gave him 2250 cc. of salt solution, with 15 minims of adrenalin in the vein and 1 dram tr. digitalis. At the conclusion of this time, he was pink in color, rather cheerful, and talked freely. Thirty minutes before, he had been stupid, cyanotic and pulseless, and looked as if he might never leave the table alive. After washing his stomach, we sent him back to the ward. The next day (24th) we took him back to the operating room, gave him a pint of blood from one of his brothers, and two pints of salt solution (1000 cc.), again returning him to bed. On the third day, we took him back to the operating room, gave him 500 cc. of 6 per cent glucose and 2 pints more of salt solution. We immediately gave him an ether anesthetic, opened the old incision and did a posterior gastro-enterostomy. This man left the table at the end of one hour with a pink skin, pulse of 90, in good general condition. He developed a bilateral parotid infection which, to some extent, retarded his convalescence. However, this man made a gradual though gratifying recovery, leaving the hospital four weeks after the second operation. We believe that it would have been impossible to have operated earlier upon this man; that he would not have withstood the shock of a serious operation, had he not been properly prepared by keeping up his body fluids, and giving him some food other than just water. When seen in September, 1923, he was well, had gained 30 pounds, and was having no trouble except a facial paralysis of one side, following his parotid abscess.

POINTS TO REMEMBER AT THE TIME OF OPERATION.

(1) A large, soft pad, from 4 to 6 inches thick, and a little wider than the operating table.

(2) Plenty of fluids in the veins, giving the heart something on which to contract before the anesthetic starts, and oft-repeated after its conclusion.

(3) Sharp dissection throughout the operation, using as little tension as possible.

(4) Very careful and complete conservation of blood, and careful hemostasis, even though it takes a little longer.

(5) Complete work, complete operation—even at a little greater risk, because of the smoother type of convalescence.

(6) A suction apparatus always at hand to remove fluids, pus and blood; and avoid the use of sponges as much as possible; suck out the blood and do not sponge.

(7) There is no question but that the practice partially carried out in some of our clinics, of using an instrument or needle only once during an operation, a hemostat only once, has actual value in preventing even slight infection. The repeated use of needles and instruments has no doubt been the cause of many cases of post-operative infection.

GROTON BLDG.

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F. Hoeffer McMechan, A.M., M.D., *Editor*
Avon Lake, Ohio, U.S.A.

January. Editorials. 1925

INTERNATIONAL ANESTHESIA RESEARCH FOUNDATION

An incident of great importance to the future of anesthesia occurred during the First Annual Meeting of the Eastern Society of Anesthetists, in New York City. In prefacing one of the Research Sessions, it was the privilege of Dr. F. H. McMechan. Secretary General of the Associated Anesthetists of the United States and Canada, to announce two gifts which may make possible the establishment of an International Anesthesia Research Foundation.

It will be recalled that Dr. James H. Cotton of Toronto, Canada, re-introduced ethylene into the field of anesthesia, in 1917, before meetings of the Canadian Medical Association and the Interstate Anesthetists. At that time Dr. Cotton was interested in securing some synergist for ether that would render it a more desirable anesthetic for war purposes. Coupled with his researches in ether synergists he projected the controversy regarding the anesthetic properties of pure ether, which still continues.

At the New York meeting Dr. Cotton presented a splendid paper on the chemistry of ethylene, especially in relation to its production by the ethyl ether-sulphuric acid process; its purification for anesthesia purposes; and the utility of metallic catalysis in making possible its commercial production as an anesthetic agent at a reasonable cost.

Dr. McMechan was able to announce in this connection that Dr. Cotton had placed all patents and processes, covering his years of research work, in trust to the Associated Anesthetists of the United States and Canada, so that they could be made available to manufacturers on royalty and all proceeds from such royalties could be used in establishing the James H. Cotton Fund of the International Anesthesia Research Foundation.

In this way the Associated Anesthetists would be able not only to further research in anesthesia, provide purer and better ethylene, but also could honor one whose investigations have added so much to the specialty of anesthesia.

During the same research session Mr. M. B. Cheney, a Cleveland chemist, presented a paper in which he detailed a new method of purifying nitrous oxid from nitric oxid contamination by passing the gas through finely divided metals. Mr. Cheney, like Dr. Cotton, also presented his patents and processes in trust to the Associated Anesthetists so that all royalties therefrom, could be used for the M. B. Cheney Fund of the International Anesthesia Research Foundation.

These gifts mark an epoch in the relations of research to its own advancement, and it is hoped and expected that other investigators will follow the splendid examples that have been set; and that in so doing the International Anesthesia Research Foundation may presently be in a position to accomplish great things in fostering research, perfecting manufacture, assuring absolutely pure anesthetics and in protecting and benefiting suffering humanity.—McM.

1925—SPRING MEETINGS—1925

Never have prospects been better than those for the Spring Meetings of the Associated Anssthetists of the United States and Canada.

Those who attended the Niagara Falls Meeting of the Canadian Society of Anesthetists will recall that the Ontario Medical Association was the host of that auspicious occasion. This same courtesy is again being extended the Canadian Anesthetists for the Fifth Annual Meeting in Toronto, May 5-8.

All the activities of both meetings will be centered in the King Edward Hotel. The policy of the program will be directed toward presenting all topics in their relation to the General Practitioner, and it is expected that a Symposium on Anesthesia from this viewpoint will be a feature of one of the General Sessions.

The profession of Toronto is noted for its entertainment and as all of the social events of the meeting will be in common, a most enjoyable time is in prospect for all anesthetists and their ladies. It is hoped by the Canadian Anesthetists that many American and Foreign Anesthetists will attend and take part in the program.

The dates and locations of the Canadian Meeting and the Congress of Anesthetists could not be more

conveniently arranged for Foreign Visitors. The Congress of Anesthetists will be held at The Breakers, Atlantic City, May 25-28, during the week of the American Medical Association. In this way, after enjoying the Toronto Sessions Foreign Anesthetists would have ample time to visit any Clinics and see any work they may wish to before going on to Atlantic City for the Congress. They are urged to avail themselves of this unijue opportunity for making contact with their Fellows of the Specialty in the United States and Canada, and they may rest assured of a most cordial welcome and friendly hospitality.

Atlantic City is a most enjoyable convention city, and aside from its own attractions, there will be other delightful social events, as well as the Annual Dinner-Dance.

Yosemite is the one big thrill of a lifetime and the Pacific Coast Anesthetists will again meet in the Valley with the California State Medical Society, May 18-21. No meeting could possibly be held in the shadow of more impressive scenic grandeur, nor in the midst of more inspiring fellowship; so pack all your troubles in the old kit bag, hit the long trail through the Redwoods and be with the Pacific Coast Anesthetists at Yosemite.

Aside from the scientific fare of the program, the Redwood Lodge and Camp Curry will provide delectable rations for the department of the interior and the personal contacts will be soul-satisfying. If you tire of everything else you can have your fill of primeval nature. My how the family would enjoy a few days in the Valley. Bring them along for a glorious time!

Noted Anesthetists, Surgeons, Specialists and Research Workers will contribute the best of current advances in the art and science of Anesthesia to the several programs. At the Congress in addition to the usual scientific sessions there will be a course of Postgraduate Lectures. All those who are interested in appearing on the programs of any of the three meetings are requested to send the title and abstract of their papers to the respective Secretaries. Foreign Anesthetists are especially invited to take part in the programs.

Now that the Associated Anesthetists of the United States and Canada has become the Parent Organization and is functioning through its Advisory Council in promoting the Regional Meetings and programs, and through the Council on Teaching and Hospital Service is fostering the advancement of the specialty, it is hoped that every anesthetists, with the future of the specialty at heart will not only join the Regional Societies in the territory of which he is located, but also the Associated Anesthetists so that the larger purposes of the specialty may be accomplished.

The National Anesthesia Research Society, at the last meeting of its Board of Governors, was placed in trust to the Associated Anesthetists as its Research and Publication Society, with a new temporary Board of Professional Governors. The N. A R. S. will not only continue but also enlarge its research and publication activities, and the support of all anesthetists is solicited.

For further details of the meetings, membership, dues and other particulars, Address

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